SERVICE MANUAL 6231

ELECTRIC SWITCH MACHINE
YM-4
DUAL CONTROL, TRAILABLE

THIS MANUAL SUPERSEDES SM-6231 DATED OCTOBER, 1982

November, 1986 (Rev. 1/87)
ID1149A/DN0007A
D 11/87-75-2430-3

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REVISION INDEX

This service manual supersedes all previously issued 6231 manuals, and has been reissued to provide new and/or corrected data. Destroy all previously issued 6231 manuals. Future revisions to this manual will be handled by addendum, wherein a Revision Index page will be provided listing all revised pages.

PAGE	REVISED
B-8	1/87

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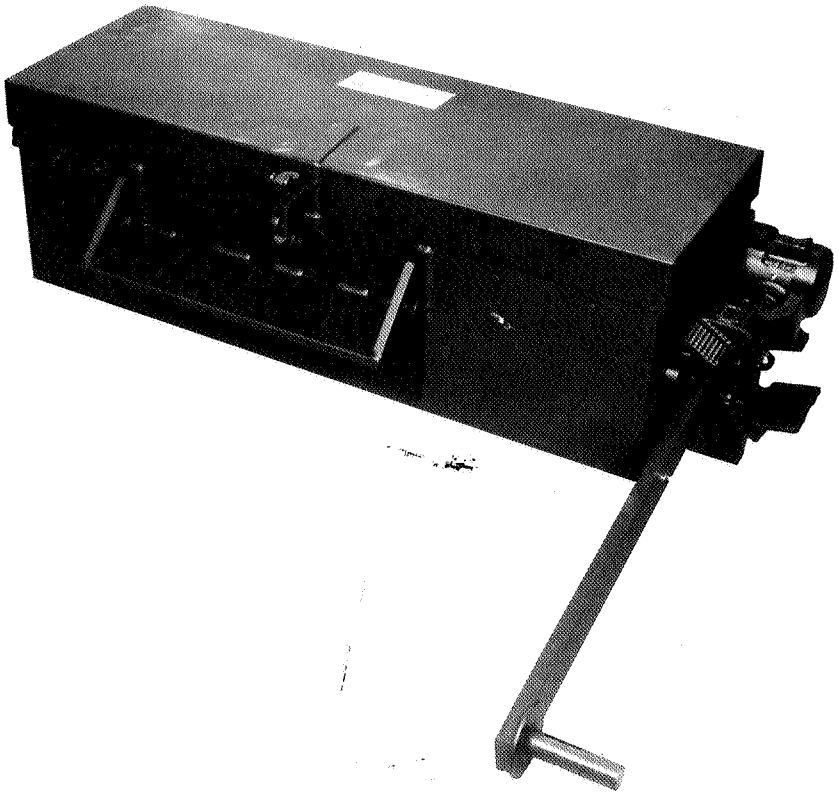
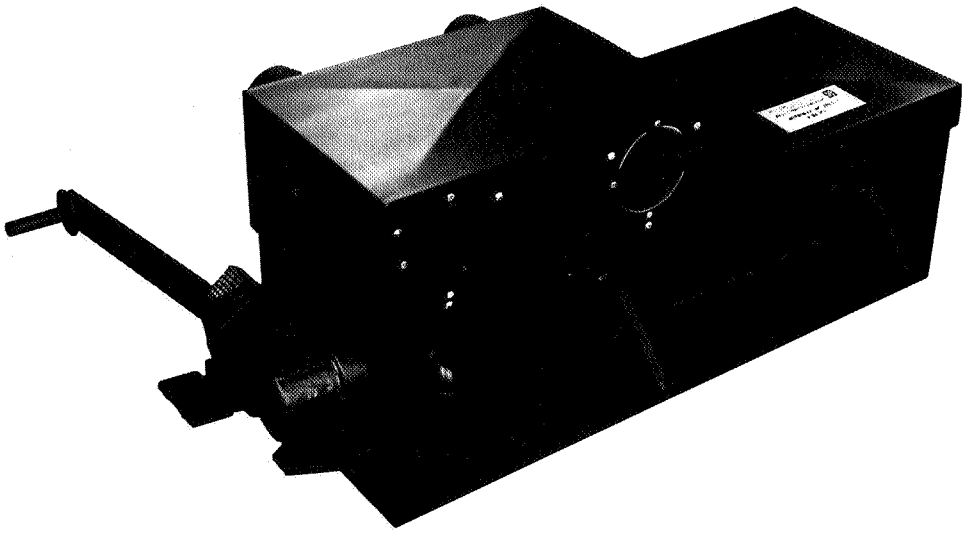


Without Position Indicator Lights



With Position Indicator Lights
YM-4 Dual Control Electric Switch Machine

SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

The YM-4 is a trailable, dual control electric switch machine for rail transit systems and yards where an electrically powered machine is required. It is designed for use in transit yards, receiving and departure areas of classification yards, industrial sidings and flat switching or storage yards.

1.2 DESCRIPTION

The mechanism of the YM-4 is totally enclosed in a weatherproof all steel case measuring, with standard cover, 13-1/16" high x 12-7/8" wide x 43-1/2" long. Mounting lugs are provided on both sides of the case for firmly securing the machine between the ties, providing a mounting arrangement that lowers the machine profile to 7-5/16" above the top of the ties. The same machine and operating rod can be used in right hand or left hand applications. The typical YM-4 track layout has a straight operating rod which connects to the basket. The stroke of the operating rod is internally adjustable from 3-1/2" to 6" and allows the YM-4 to be utilized with different switch throws.

The major components of the YM-4 switch machine (Figure 1-1) are the case, motor/clutch/gearbox/main shaft assembly, main crank assembly, toggle spring assembly, hand-throw assembly, and controls/wire harness.

Two pairs of independently adjustable control switches are provided. One pair consists of SPDT switches which are used in a holding circuit, and one pair of DPDT switches which are used for motor cutout, non-vital point indication, and local indication (lights). (Also optional with NWP/RWP relay control.)

A hand throw lever is provided to operate the switch machine when manual operation becomes necessary, or desired.

An optional cover is available with position indicator lights (bulbs are to be ordered separately.) Either cover can be removed to provide convenient access for maintenance and adjustments.

The serial number is stamped on the mounting flange (see Figure 1-1).

1.3 SPECIFICATIONS

1.3.1 Physical Characteristics

a. Overall Dimensions	See Figure 1-2
b. Weight (Approx.)	450 pounds

1.3.2 Operating Characteristics

a. Stroke	Adjustable from 3-1/2 to 6 inches
b. Operating Time	2 seconds
c. Force on Switch Rod, Extreme Position	1,000 pound minimum
d. Trailing Speed	5 MPH Max.

1.3.3 Electrical Data

a. Motor

Voltage	115 VAC	230 VAC	115 VDC
Horsepower	1	1	1
Hz	60	60	--
Phase	1	1	--
Current:			
Full Load	14.6	7.1	10.0
In Rush	42.0 (100m sec.)	28.5 (125m sec.)	44.0 (200m sec.)
Clutch Slip (Max.)	16.0	8.0	12.5

* Motor will operate satisfactorily on voltages within 10% of nameplate value.

b. Reversing Contactor - AC Control (115 VAC)
(Contactor will operate at 70% of rated voltage.)

Rating	1 HP
Coil Current	150 Milliamps
Contacts @ 115 volts ac	15 Amps
Auxiliary Contacts @ 115 volts ac	5 Amps

c. Reversing Contactor - DC Control
(Contactor will operate at 80% of nominal voltage with 10% overload.)

	24-28Vdc	12Vdc
Rating	1 HP	1 HP
Coil Current	.192 Amps	.375 Amps
Voltage (Minimum)	22.5Vdc	9.6 Vdc
Contacts	15 Amps	15 Amps
Auxiliary Contacts	5 Amps	5 Amps

d. Control and Indication Switches S1, S2, SL, SR
Type: Snap Action Switches (SPDT, DPDT)
Rating - 10 Amps @ 125/250 VAC
Vibration Resistance 25G's @ 2,000 CPS
Mechanical Life 10,000,000 Cycles Minimum
Elec. Life 750,000 Cycles
Overtravel 0.015 Min.
Release Force 4 oz. Min.
Ambient Temp. Range -65°F to 275°F

e. Clutch
Voltage 90 VDC Rated (Operated from DC or rectified AC)

Clutch Operating Voltage	28 Vdc ± 2Vdc
Resistance (Ohms)	452
Amps	0.199 at 90 Vdc
Watts	18
Operating Temp. Bearings	-80°F to 300°F

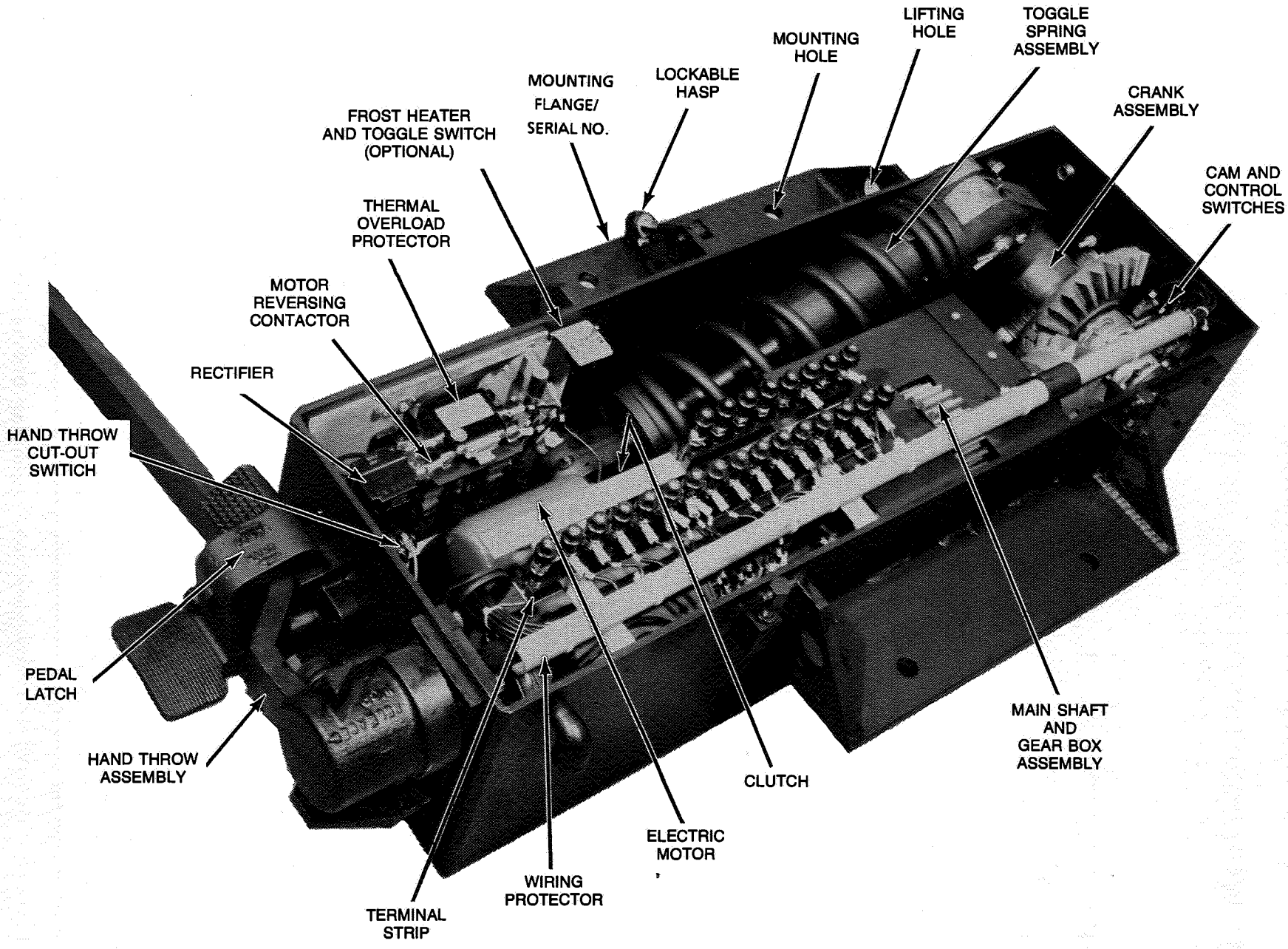


Figure 1-1. 115V AC YM-4 Electric Switch Machine, Internal View, Cover Removed

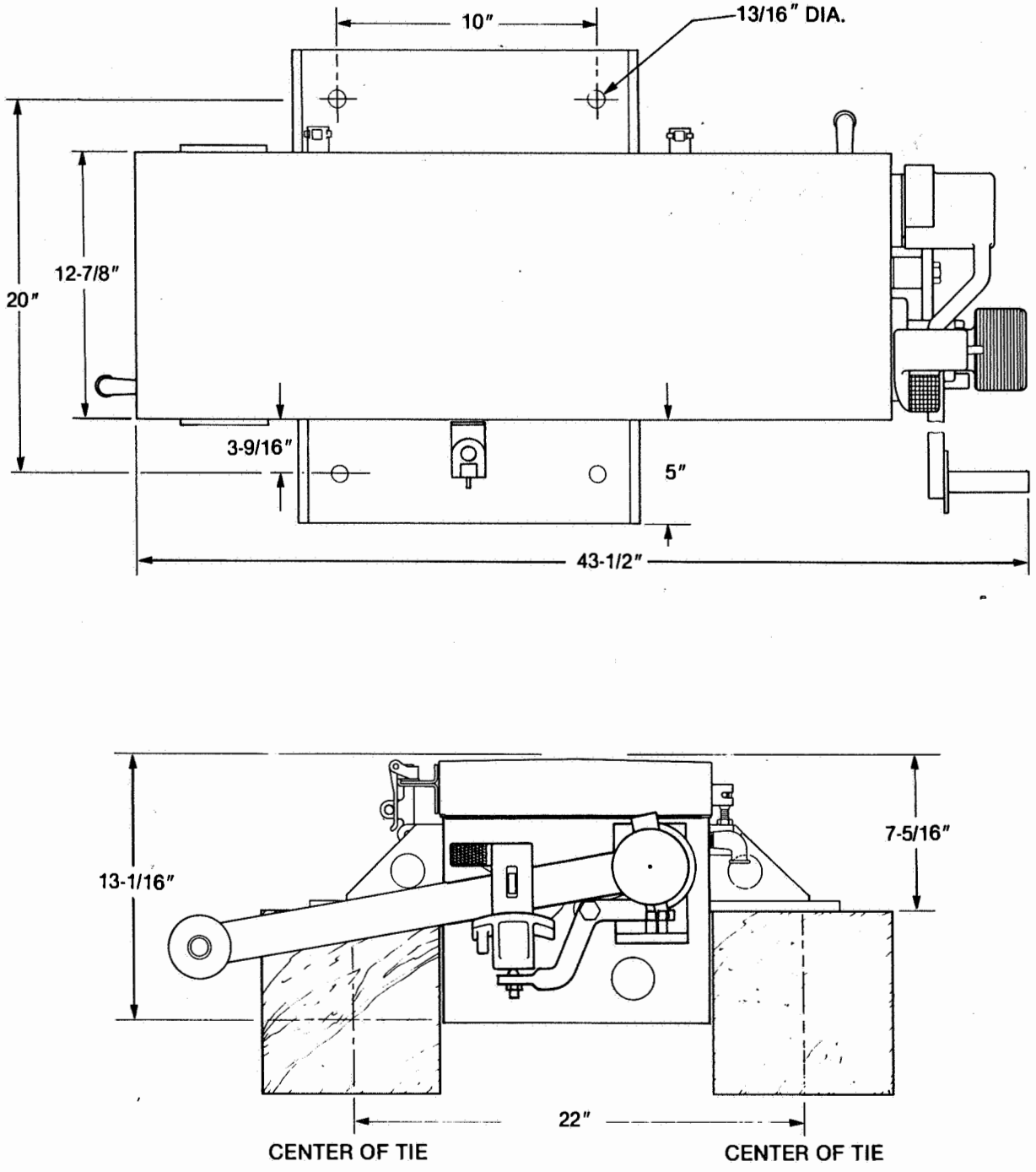


Figure 1-2. Mounting Dimensions

SECTION 11
INSTALLATION AND ADJUSTMENT

2.1 GENERAL

A typical track layout plan of the YM-4 switch machine is shown in Figure 8-2 with optional U5 circuit controller and junction box. Detail mounting plans approved by the railroad should be followed when installing the machine. No special tools are required for installation. Mounting dimensions for the switch machine are shown in Figure 1-2. AREA yard signal equipment clearance diagram is shown in Figure 2-1.

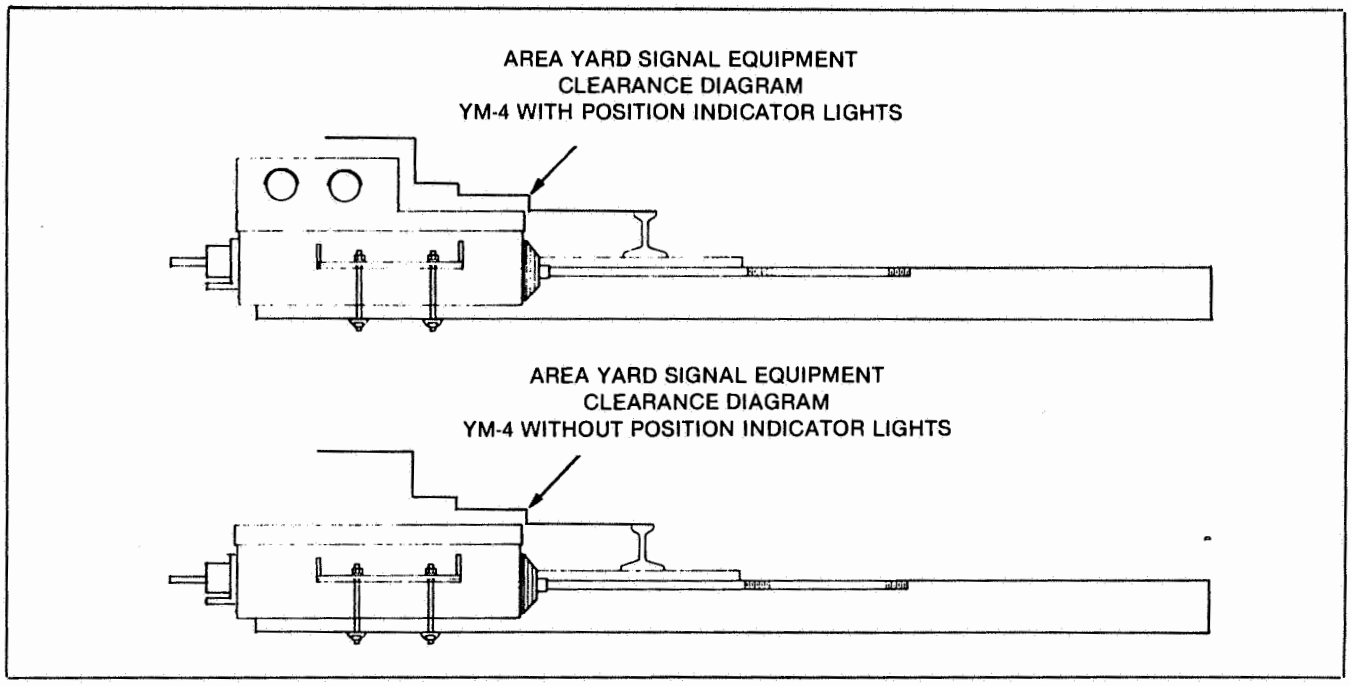


Figure 2-1. Clearance Diagram

2.2 MOUNTING

After the machine has been properly assembled for the layout, proceed as follows:

NOTE
The throw of the machine is recommended to be 1-inch greater than the throw of the points.

a. Place the rubber boot (bellows) item 32, Figure A-1 (in the Appendix) on the operating rod, having the open end facing away from the switch.

b. Place the metal bracket, item 33, over top of the rubber boot.

c. Install rod on switch adjuster bracket.

d. Slide operating rod through opening in case and mate with the eyebolt.

e. Mount and fasten the machine on ties in accordance with layout plans applying to the particular location.

f. Connect the external wiring to the terminal board in accordance with the wiring diagram applying to the particular location. Main terminal board wiring scheme is shown in Figures 8-3 through 8-9. Approved wiring plans should be followed for actual wiring. However, these diagrams can serve as an aid in developing the master plans.

g. Adjust the eyebolt according to the total movement of the switch points. Refer to Figure 2-2, and proceed as follows:

1. Refer to the table in Figure 2-2 and determine "A" dimension. "A" dimension will vary depending on throw of points. For example, if the throw of the points is 4-3/4 inches, "A" dimension should be 3.96 inches.

2. Adjust eyebolt to proper "A" dimension by turning eyebolt in or out. "A" dimension is the distance from the machined surface of the shaft to the tip of the eyebolt.

h. Attach the operating rod to the adjustable eyebolt with pin provided. Secure with cotter pin.

i. Attach metal bracket and rubber boot to case with screws that are holding the shipping plate over the case opening.

2.3 HAND LEVER CUTOUT SWITCH

a. Check the adjustment of the hand-lever cutout switch to make certain the switch operates as the foot-pedal is depressed. The switch must "click" before the top of the foot-pedal clears the hand-throw lever to assure that simultaneous handlever and power operation will not occur.

b With the hand-throw lever out of the foot-pedal stand, try to close the foot-pedal to make sure the pedal will not close and the switch does not "click".

2.4 SWITCH ROD ADJUSTMENT

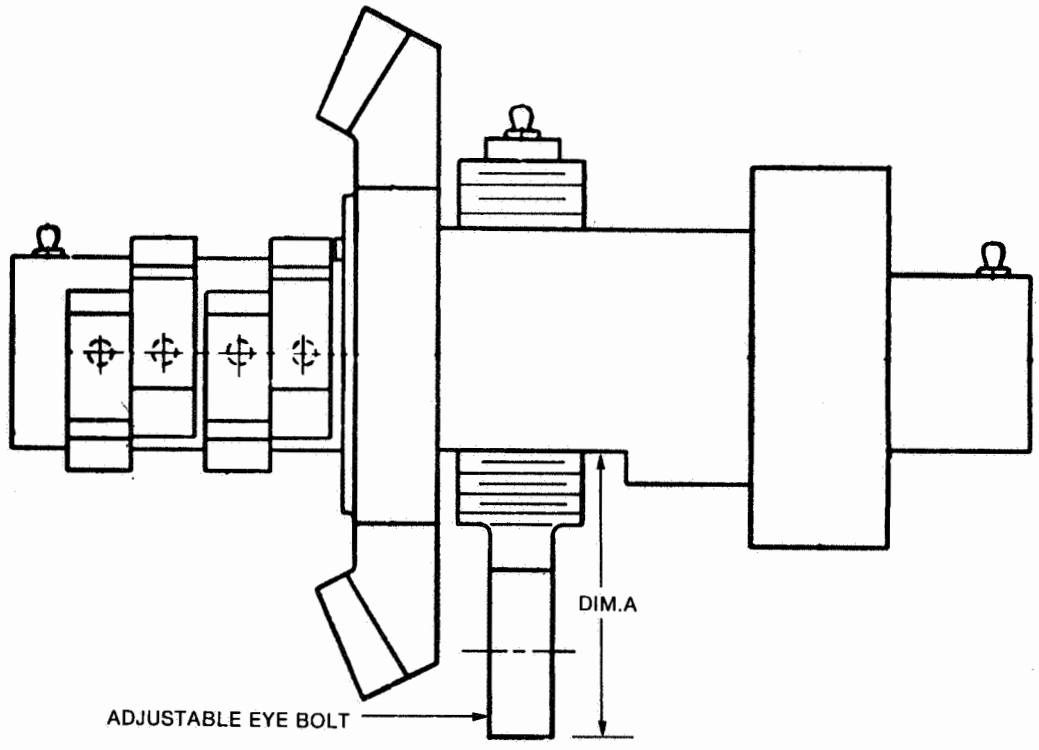
WARNING

While making switch rod adjustments, make sure the hand-lever cutout switch is operating per paragraph 2.3 and foot-pedal is fully depressed. Inadvertent operation could cause personal injury.

After the switch machine has been installed and wired in accordance with the approved switch plans, it must be adjusted to obtain proper operation and develop the required forces on the operating rod. Use the following procedure to produce the specified holding force on the switch rod (See Figure 8-2).

a. Set the handlever so the operating rod is in the "in" position and the switch point against the near rail. Tighten the far basket nut until all the slack is removed from the switch rod components.

Throw of Points	Recommended Play In Basket (Total)	"A" Dim.	Throw of Machine
Inches		Inches	Inches
2	1"	2	3
2-1/4	1"	2.18	3-1/4
2-1/2	1"	2.36	3-1/2
2-3/4	1"	2.54	3-3/4
3	1"	2.71	4
3-1/4	1"	2.89	4-1/4
3-1/2	1"	3.07	4-1/2
3-3/4	1"	3.25	4-3/4
4	1"	3.43	5
4-1/4	1"	3.60	5-1/4
4-1/2	1"	3.78	5-1/2
4-3/4	1"	3.96	5-3/4
5	1"	4.14	6



Note: Adjust "A" Dimension to Corresponding Throw of Points

Figure 2-2. Machine Stroke Adjustment

b. Move the operating rod to the "out" position with the handlever and move the switch points against the far rail. Tighten the near basket nut until all the slack is removed from the switch rod components.

c. Return the operating rod to the "in" position by the handlever. This should move the near point up against the near stock rail. Tighten the far basket nut until the main crank has rotated approximately 5 degrees.

d. Fasten the operating boot to the operating rod with the band clamp. Compress the boot to a comfortable position in toward the machine.

e. Move the operating rod to the "out" position by the handlever. Check to make sure the boot is not overextended. Tighten the near basket nut until the main crank has rotated approximately 5 degrees.

f. Operate the switch several times by hand to see if the tension is maintained. If it is, tighten the basket lock nuts and again check for tensions.

2.5 ELECTRIC AND CONTROL ADJUSTMENTS

After completion of the switch rod adjustments described in paragraph 2-4, check the motor limit and indication switches as follows (these switches are preset at the factory):

2.5.1 Motor Limit and Indication Switch Adjustment

a. Loosen button head cap screw on four cams on the main crank (item 14, Figure A-1).

b. Rotate cams to insure limit switches "click" on and off.

c. If switches don't click, loosen the two 1/4-20 nuts and bolts and adjust the switches in or out from the crank until the cams will activate the appropriate switch. Tighten the 1/4-20 nuts and bolts.

Note

Maintain proper over travel on switch after adjustment (See paragraph 1.3.3.d.).

d. Throw the switch machine so the main crank is at mid-stroke (toggle point). Rotate the two inside cams for switch S1 and S2, to activate, (deactivate) the switches simultaneously, then tighten screws.

e. Complete stroke to the "out" position. Rotate the cam, for switch SL, (case side), to activate switch. Rotate cam an additional 10°.

f. Hand throw the machine to the "in" position of the main crank. Rotate the cam, for switch SR, (on the gear side), to activate the switch. Rotate the cam an additional 10°.

g. Tighten the (4) four button head cap screws.

2.5.2 Electromagnetic Clutch Adjustment

a. Clutch Operating Voltage

CAUTION

THE FOLLOWING MEASUREMENTS ARE MADE WITH THE MACHINE IN OPERATION. BE CAREFUL NOT TO COME IN CONTACT WITH ANY MOVING PARTS OR ELECTRICAL TERMINAL POSTS.

NOTE

Step 1 is needed only on 230 volt machines.(N451613-0103,-0107,-0111)

1. Measure the line voltage across AAR terminals 13 and 15 with the machine in operation.

   NOTE: Make several measurements to confirm readings.

2. Measure the DC clutch operating voltage, (+) lead to clutch wire on variable resistor (-) lead to Pin 7 on base of plug-in power supply (see Figure 2-3 for Pin 7 reference).

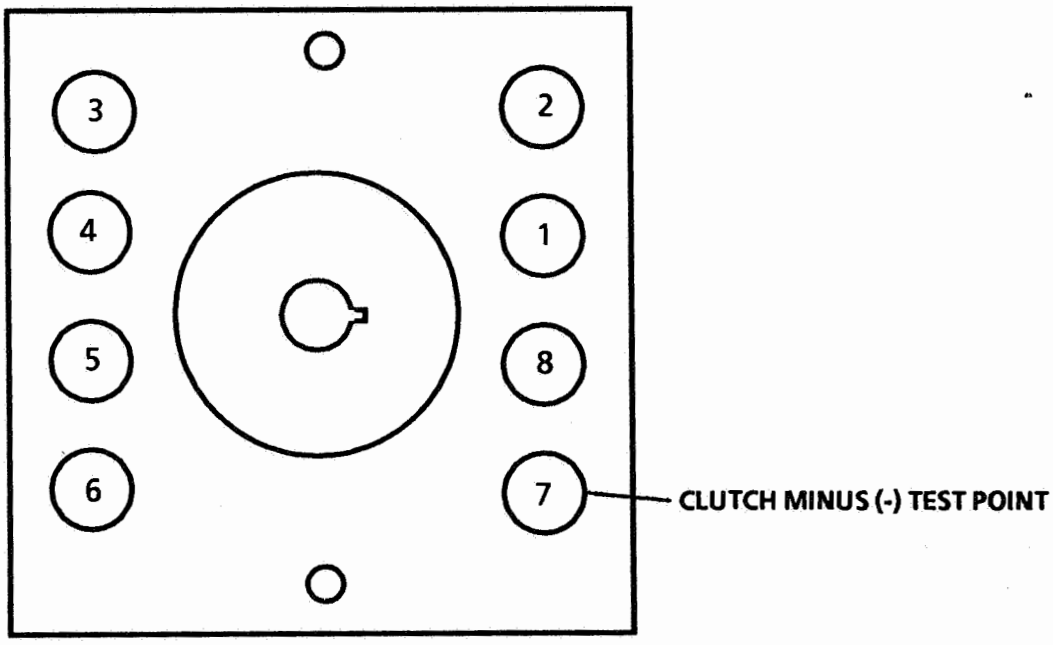


Figure 2-3. Top View of Octal Socket Pin Layout

For all 115 VAC and 115 VDC machines, the clutch voltage is in within tolerance if it is 28 ± 0.2 Vdc.

For the 230 VAC machines (N451613-0103, -0107 and -0111), the clutch voltage is in tolerance if it falls within the limit shown in Table 2-1.

Table 2-1

AC Input Voltage		DC Clutch Voltage
200 - 205		26.0 - 26.7
205 - 210		26.7 - 27.3
210 - 215		27.3 - 27.8
215 - 220	- NOMINAL -	27.8 - 28.2
220 - 225		28.2 - 28.7
225 - 230		28.7 - 29.2
230 - 235		29.2 - 29.8
235 - 240		29.8 - 30.0

b. Clutch Voltage Adjustment

1. The clutch voltage may be adjusted by removing power from the switch machine and relocating the position of the slider on the wirewound resistor (item 71 on page A-5/A-6 or B-5).

2. Re-test the clutch voltage to verify that the voltage is within limits of 28 ± 0.2 VDC for 115 volt machines, or Table 2-1 for 230 volt machines.

NOTE: Be sure to tighten the set-screw on the resistor slider when final adjustment is complete.

2.6 INITIAL LUBRICATION

Before leaving the factory, all working parts of the machine are well lubricated. Unpainted and unplated parts are coated with a special lubricant designed to protect these parts against corrosion.

To insure reliable operation, lubricate the switch machine according to this section before placing in service. During service, lubricate at periodic intervals determined by the railroad. Use the following lubrication chart.

LUBRICATION CHART

Point of Application	Type of Lubricant	Method	Apply To
A. (6 Locations)	Grease, Alemite M7650-01 (A041089)	Grease Gun	Grease Fittings
B. (2 Locations)	Grease, Stazon M M7652-2 (A041477)	Brush	All geartooth surfaces
C. (1 Location)	Machine Oil (10W-30 or equivalent)	Oil Can	Bushing, Pin

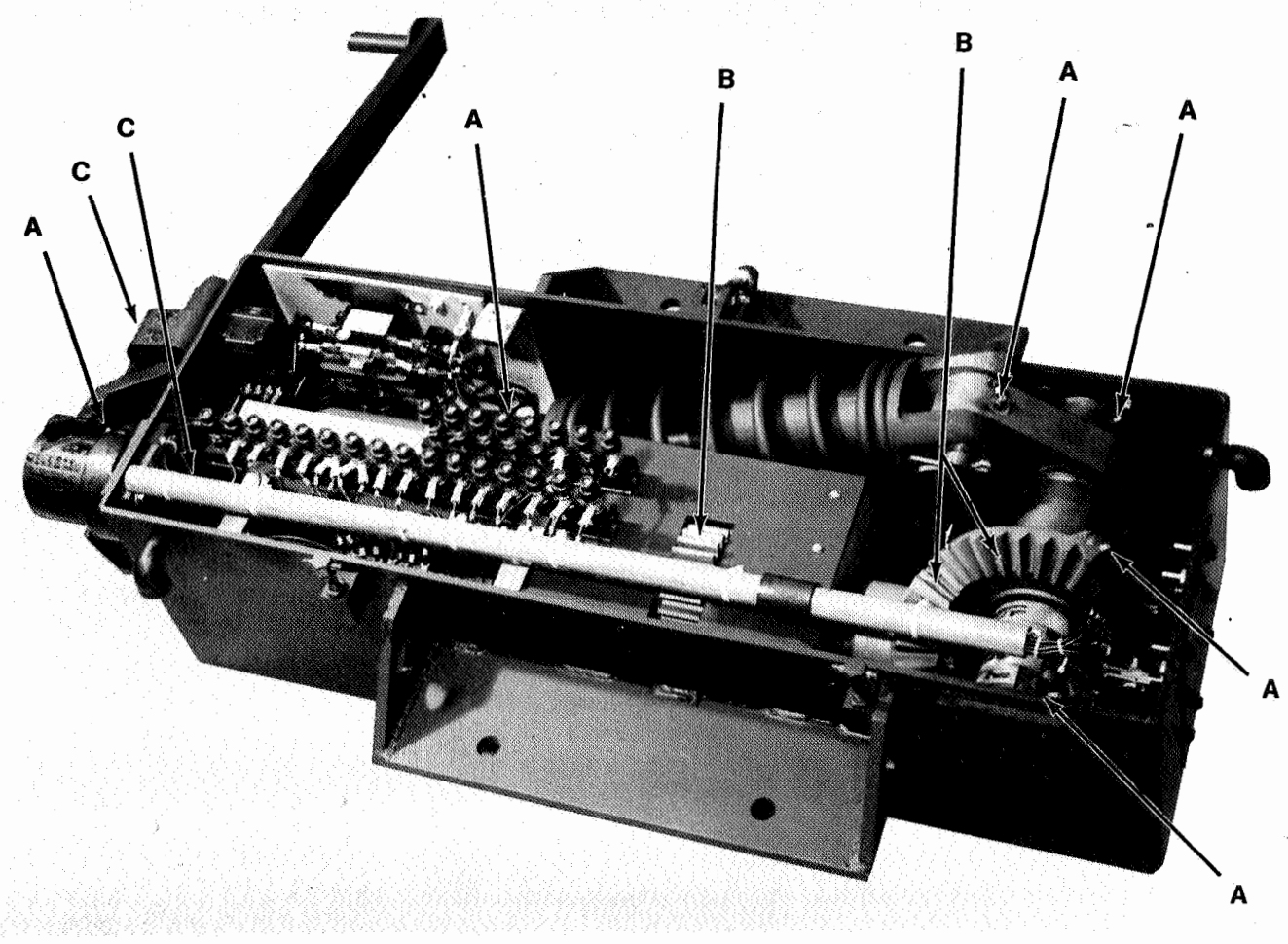


Figure 2-4. Lubrication Points

SECTION III
OPERATION

3.1 MODES OF OPERATION

The switch machine has basically three modes of operation: power operation, hand-throw operation, and trailing operation.

a. The power mode electrically drives the main shaft 180° and rotates the main crank 90° to move the operating rod and switch points.

b. The hand-throw mode manually operates the points the same as electrically by rotating the main shaft. But during the hand-throw operation, only the gearbox is driven. The motor is disconnected from the drive train due to the electro-magnetic clutch. This clutch is only energized (engaged) when the motor is energized. The cutout switch will break the circuit to the motor reversing contactor preventing the motor from being energized.

c. When the switch points are trailed, the operating rod rotates the main crank, thus compressing the toggle spring to mid-stroke and then allows the toggle spring to complete the operation.

3.2 MANUAL OPERATION

To operate the YM-4 manually, follow this procedure:

1. Remove padlock from foot-pedal latch.

2. Depress foot-pedal to unlatch the hand-throw lever.

3. Raise hand-throw lever and complete the movement to operate the switch. Note that slightly beyond mid-stroke, the spring toggle action becomes operative to complete the stroke.

4. Rotate lever counterclockwise and engage lever into latch stand and secure with lock.

The electric motor does not function during manual operation. And during electric operation, the hand-throw lever does not go through the cycle. The hand throw lever must be in its latch with the foot pedal closed during trailing operation (see paragraph 4.6).

SECTION IV
OPERATING PRINCIPLES

4.1 GENERAL

The switch points are either thrown electrically (refer to para. 4.2) or manually (refer to para. 4.3). The points are held in position by a 600#/in. toggle spring mounted on the main crank, which is compressed 1-2/3 inches. (NOTE: The clutch is deenergized (disengaged) when the motor is deenergized to facilitate trailing and hand operation.) The toggle spring maintains a minimum holding force to the closed points of 1,000 pounds. The switch throw is adjustable from 3-1/2" (with basket) to a full 6 inches. Operating time is approximately 2 seconds. Motor control and switch indication are obtained from contacts operated by cams on the main crank and are directly associated with the switch position.

The following paragraphs provide brief operating principles of the YM-4 Switch Machine. This information may be helpful in troubleshooting and maintaining the switch machine.

4.2 SWITCH OPERATING MECHANISM (See Figure 1-1)

The electric motor, controlled by an electromagnetic, reversing contactor, drives the gear box through an electromagnetic clutch. An output gear in the gear box meshes with the spur gear on the main shaft assembly, rotating the main shaft 180°. Through a set of bevel gears, the main shaft drives the main crank, rotating the main crank 90°. The operating rod, which is connected to the eyebolt on the main crank, is then driven a predetermined distance.

During the first half, (45°), of the switch operating stroke, the toggle spring is compressed and the toggle mechanism is rotated to dead-center. As the machine continues, the toggle mechanism is driven past center, where upon the spring force assists the motor in completing the stroke. Since the holding force of the spring is equal to that used at spring switches, the motor is turned off and the clutch disengaged at the end of the stroke. The clutch is engaged only while throwing the switch by power.

4.3 MANUAL (HAND LEVER) OPERATION (See Figure 4-1)

Removal of the padlock from the foot-pedal latch and subsequent foot depression of the latch will unlatch the hand-throw lever. A plunger is directly connected to this latch which will, through a limit switch, interrupt the electrical circuit to the motor reversing contactor and open a circuit to inform the controller that the switch machine is in manual mode of operation. An external interlocking lever prevents accidental closure of the latch while the hand-throw lever is out of the lever stand. When the hand-throw lever is removed from its stand, the cam surface on the lever hub forces the interlocking lever in a clockwise direction, thus not allowing the latch stand to be closed.

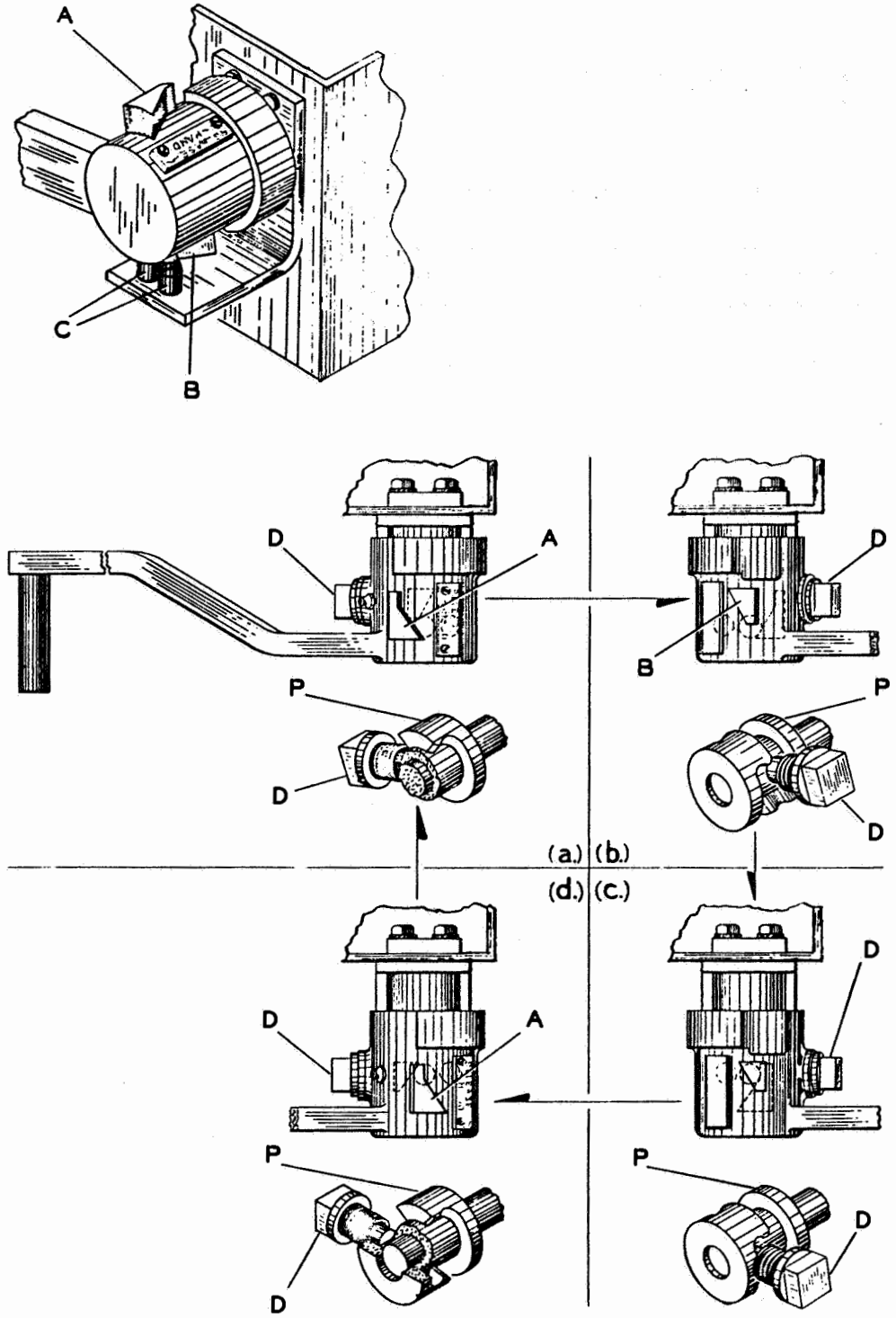


Figure 4-1. Disengagement Feature of the Hand-Throw Lever

The hand-throw lever rotates the main crank through bevel gears. Use of a disengagement collar on the main shaft permits the machine to complete its stroke after the toggle spring goes over dead center, without reaction on the hand-throw lever. The hand-throw lever does not move during power operation of the switch, although the main shaft does rotate. Figure 4-1 illustrates the disengagement feature of the hand-throw lever. With the hand-throw lever in the latch stand, the stud D in the lever hub is positioned in the rear track of the main shaft-hand-throw shaft collar P. Figure 4-1 (a) shows the stud D in this position and the hand-throw shaft in the position that corresponds with the switch operating rod in its "out" position (near switch point open). During operation of the hand-throw lever Figure 4-1 (a) and (b), lever stud D engages the collar P, rotating the main shaft-hand-throw shaft clockwise. At slightly beyond mid-stroke, however, the toggle action becomes effective in completing the switch stroke.

Through the crank and bevel gear arrangement, the main shaft, hand-throw shaft is thereby rotated the remainder of the stoke by the spring force with no reaction on the lever. It should be noted that while the lever stud D is still in the rear track of the collar P, Figure 4-1 (b), the hand-throw lever can be returned to the latch stand without further operating the hand-throw lever. However, continuation of the lever stroke (clockwise) from the position shown in (b) engages cam A on the lever hub with the shifting stud C, forcing the hand-throw lever out into the "out" position shown in Figure 4-1 (c). Now stud D is in the front track of the shaft collar and in a position to rotate the main shaft, hand-throw shaft, when the lever is returned to the latch stand. The clockwise stroke of the lever is limited by the engagement of the flat surface of the cam A with stud D, Figure 4-1 (c).

In returning the hand-throw lever to the latch stand, the operation is similar to the clockwise stroke in that again at slightly beyond mid-stroke the toggle spring, through its action on the main crank, completes the motion of the switch points and the rotation of the main shaft. As the hand-throw lever is returned to the latch stand, cam B on the lever hub engages with stud D, Figure 4-1 (d), forcing the lever back into its original position on the shaft, with stud D, Figure 4-1 (d), in the rear track of the shaft collar. This allows the interlocking lever to rotate counter-clockwise to close the latch stand and allow the machine to return to power operation.

4.4 HANDLEVER CUTOUT DEVICE

The handlever cutout switch, COS, is opened when the padlock is removed from the handlever locking device and the device is pulled out to clear the handlever. This switch, COS, will break the electrical circuit thus preventing the motor reversing contactor to energize. This switch also supplies indication through an open circuit that the machine is in the manual mode of operation. The handlever cutout switch can be locked in the open position by installing the padlock behind the post pedal locking device, thus disabling the machine electrically.

4.5 OVERLOAD CUTOUT RELAY

A thermal overload ambient compensated relay senses continuous motor current. If the clutch slips for any reason before stroke completion, the overload relay is designed to remove power from the motor and clutch via the reversing contactor, approximately 2 minutes after the start of the switching cycle. The overload relay heater can be sized to increase or decrease the approximate 2 min. trip time. Once the overload relay has actuated, it will recycle in approximately 3 minutes.

The overload can be set for either automatic or manual operation. In automatic operation, the overload relay will automatically reset itself; in manual operation, the relay must be reset manually.

4.6 TRAILING OPERATION

Trailing a switch equipped with a YM-4 machine merely reverses the mechanism. In doing so, the toggle spring is driven over dead center by the main crank. Depending upon the control scheme used, power may or may not be admitted to the electric motor. Regardless of whether power is admitted, the toggle spring force at first opposes the initial shift of the switch points, the same as at an ordinary spring switch, but unlike action at the latter, the force required to throw the switch decreases as the switch points approach mid-stroke. During the last half of the stroke, the toggle spring assists the shift to point closure.

CAUTION

The YM-4 switch machine is designed to operate in 2 seconds. Therefore, the trailing speeds should not force the machine to throw in less than 2 seconds(5 MPH). Trailing speeds in excess of this time will produce abnormally high forces within the machine, thus decreasing the life of the machine. To avoid personal injury or damage to the machine, the hand throw lever must be in its latch with the foot pedal closed during trailing operation.

SECTION V
FIELD MAINTENANCE

5.1 GENERAL

This section outlines recommended procedures for periodic inspection and maintenance of the YM-4 switch machine.

WARNING

Remove all operating power at the nearest local break-point to avoid personal injury.

1. Connection to the switch points, including the holding force of switch rod, should be checked for proper adjustment. Refer to paragraph 2.4.

2. Check to insure all bolts are tight inside the switch machine, i.e., (8) bolts holding plates for main crank, (2) bolts for toggle spring, (4) bolts for hand-lever support, (4) bolts for gear box, (1) cotter pin for toggle spring.

3. Periodically check the "electrical and control adjustments, paragraph 2.5, and hand-lever cutout switch, paragraph 2.3, for proper operation in accordance with instructions.

4. No maintenance can be performed on the internal components of the motor. Motor oiling is only required once every 5 to 10 years.

5. Lubricating the switch machine at periodic intervals is essential. The frequency of lubrication should be determined by experience and specific applications and amount of operations. Minimum lubrication should occur not less than once every 6 months, more frequent might be necessary in specific applications. Refer to paragraph 2-6 and Figure 2-4.

SECTION VI
SHOP MAINTENANCE

6.1 GENERAL

Shop maintenance consists of restoring a damaged switch machine to an operable state. This is accomplished by repairing and/or replacing damaged parts. Refer to the parts list for ordering information and the lowest replaceable unit. The exploded view in the parts list section will aid in disassembling and reassembling the switch machine.

6.2 BEVELED GEAR WEAR PATTERN

Mark the teeth of the two beveled gears of the crank assembly with a suitable marking compound. Throw the switch machine a few times. Check the contact pattern as shown in Figure 6-1. Gears are cut with a contact pattern about half the length of the tooth, the location slightly favoring the toe end of the tooth. Under load the pattern will shift somewhat toward the heel of the tooth, and will thus become more central. Under no circumstances must the pattern be concentrated on the ends of the teeth. If an adjustment is needed, the crank assembly (Item 14, Figure A-1) can be adjusted by loosening the eight mounting bolts (17) and repositioning the crank.

The bevel gears are mated together as shown in Figure 6-2. Notice that the prick points in both gears are in alignment. Should maintenance be required that separates the bevel gears, re-assemble the machine with prick points aligned for proper gearmesh. In the event that the prick points have been worn off, see paragraph 6.3 for an alternate method of aligning the bevel gears.

6.3 ALTERNATE BEVELED GEAR ALIGNMENT

Referring to Figure 6-3, mate the first gear tooth of the half moon segment gear (as viewed from the operating bar end) with the seventh groove counterclockwise from the keyway of the pinion gear.

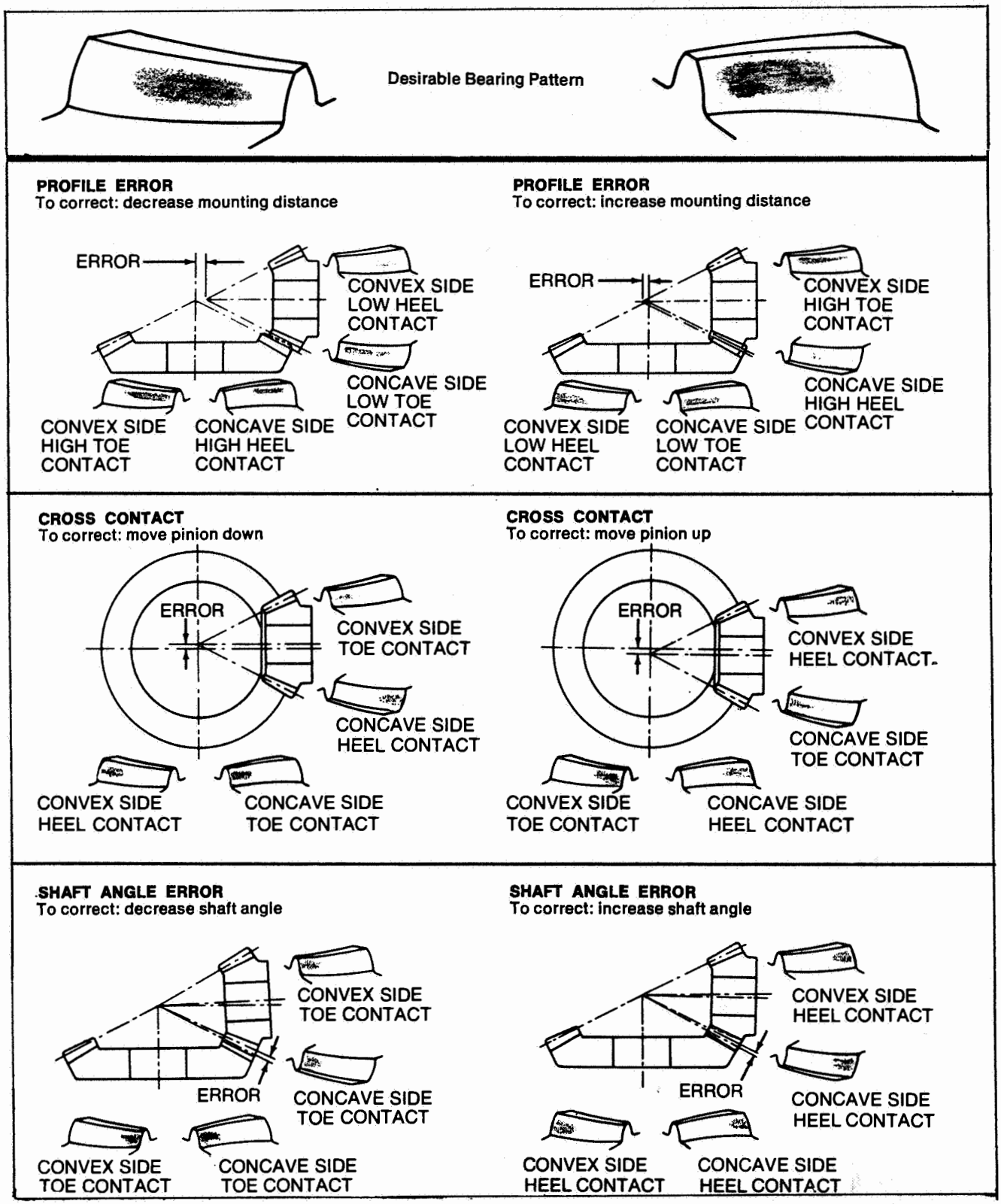


Figure 6-1. Beveled Gear Pattern

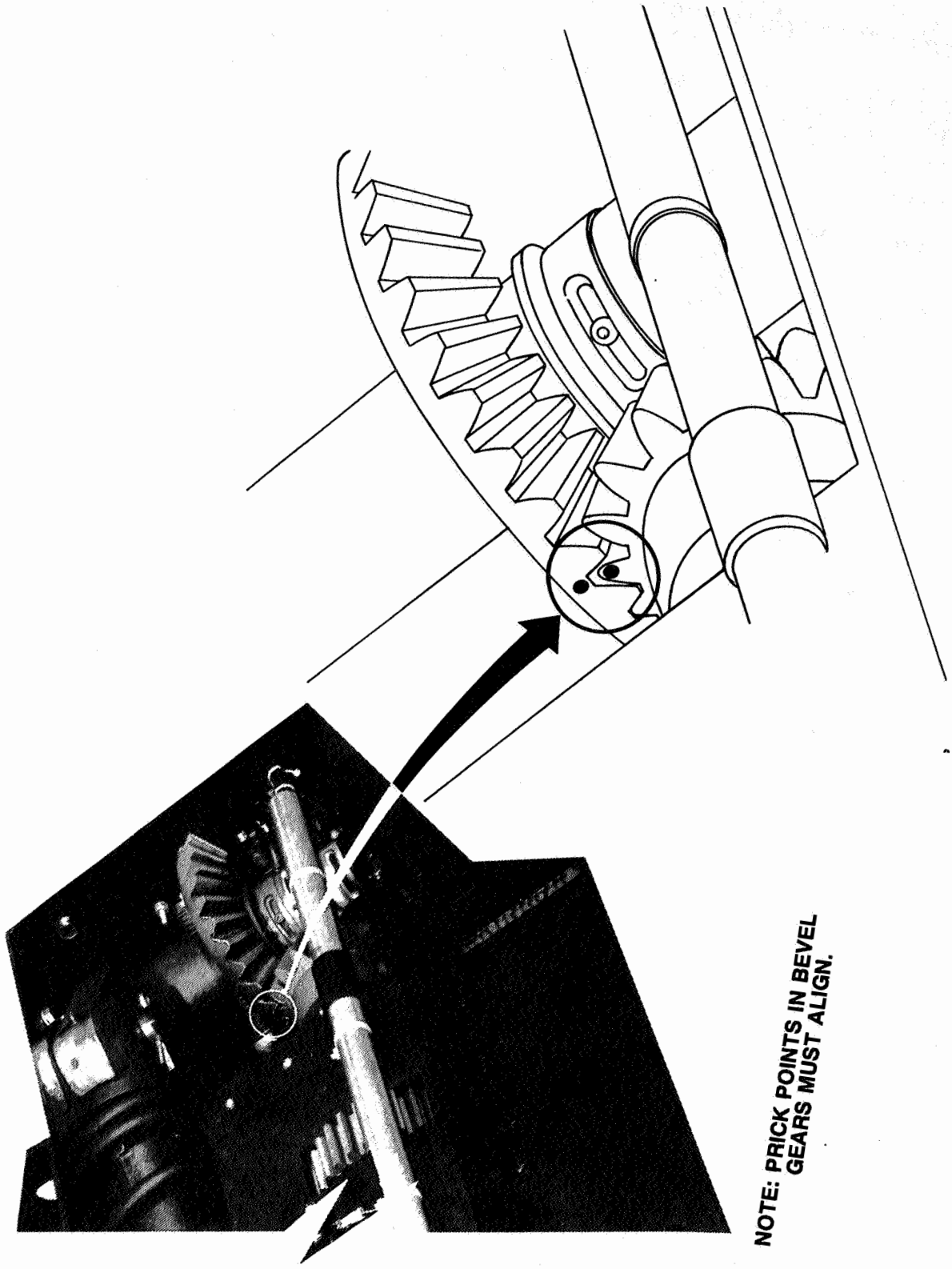


Figure 6-2 Bevel Gear Alignment

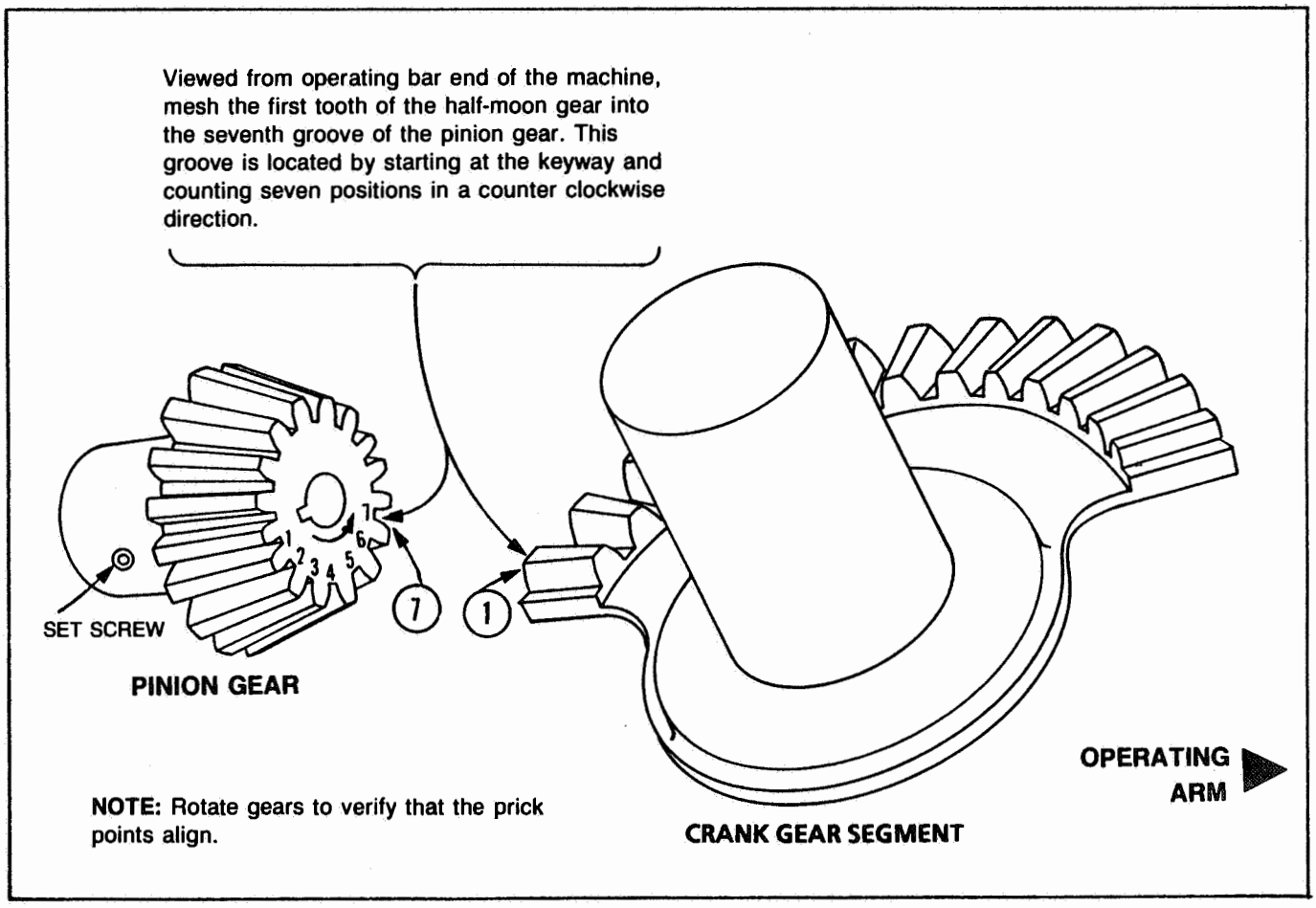

Viewed from operating bar end of the machine, mesh the first tooth of the half-moon gear into the seventh groove of the pinion gear. This groove is located by starting at the keyway and counting seven positions in a counter clockwise direction.
SET SCREW
PINION GEAR
NOTE: Rotate gears to verify that the prick points align.
CRANK GEAR SEGMENT
OPERATING ARM

Figure 6-3. Alternate Bevel Gear Alignment

SECTION VII
RECOMMENDED TOOL LIST

7.1 GENERAL

The following tabulation is a list of tools required for servicing the YM-4 Switch Machine. The part number provided is a Snap-On number but any equivalent tool may be used (tools are not supplied by US&S).

Description		Snap-On Part No.
Screw Driver	.037 x 1/4 Tip 4" Blade	SSD4
	.032 x 3/16 Tip 2-7/8" Blade	SSD2
Combination Wrenches		
	1/2"	OEB 160
	9/16"	OEX 180
	11/16"	OEX 220
	3/4"	OEX 240
Ratchet	3/8" Drive	F723
Extension	3/8" Drive x 12"	FX11
Sockets		
	1/2"	FS161
	9/16"	FS181
	11/16"	FS221
	3/4"	FS241
Hex Key Wrench	1/8"	AWL4
"T" Handle Hex Key Wrench 1/8"		GAW1608
Adjustable Wrench 6"		DA26
Adjustable Wrench 10"		DA210
Retaining Ring Pliers w/Right Angle Tip		PR349A
Slip Joint Pliers		46
Ball Peen Hammer		BP20A
AAR Wrench		
Torque Wrench - 15 Foot Pound Mid-Range		
3/8" Drive Hex Bit Holder with a 4-Inch x 5/32 Hex Bit		

SECTION VIII
DIAGRAMS

The following diagrams are included in this section.

Figure 8-1. Timing Diagram

Figure 8-2. Typical Layout, RH or LH YM-4 Switch Machine Applied to Insulated 16'-6" Single Split Switch, #15 Turnout

Figure 8-3. Typical Circuit Diagram for 115 VAC Machine, 115 VAC Control YM-4 Switch Machine.

Figure 8-4. Typical Circuit Diagram for 115 VAC Machine, 115 VAC Control YM-4 Switch Machine.

Figure 8-5. Typical Circuit Diagram for 115 VAC Machine, 115 VAC Control YM-4 Switch Machine.

Figure 8-6. Typical Circuit Diagram for 230 VAC Machine, 115 VAC Control YM-4 Switch Machine.

Figure 8-7. Typical Circuit Diagram for 230 VAC Machine, 115 VAC Control YM-4 Switch Machine.

Figure 8-8. Typical Circuit Diagram for 115 VDC Machine, 24-28 VDC Control YM-4 Switch Machine.

Figure 8-9. Typical Circuit Diagram for 115 VDC Machine, 12 VDC Control YM-4 Switch Machine.

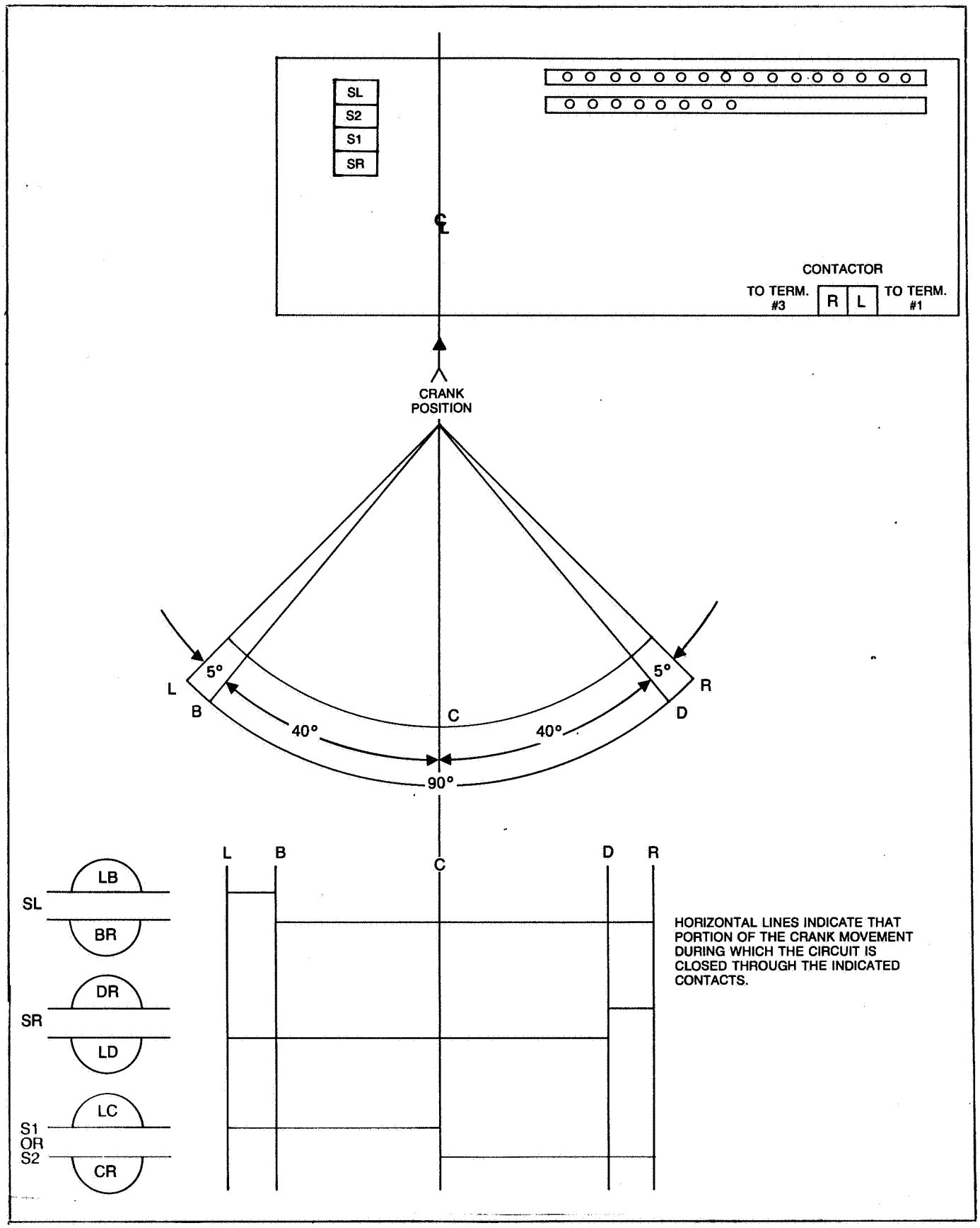
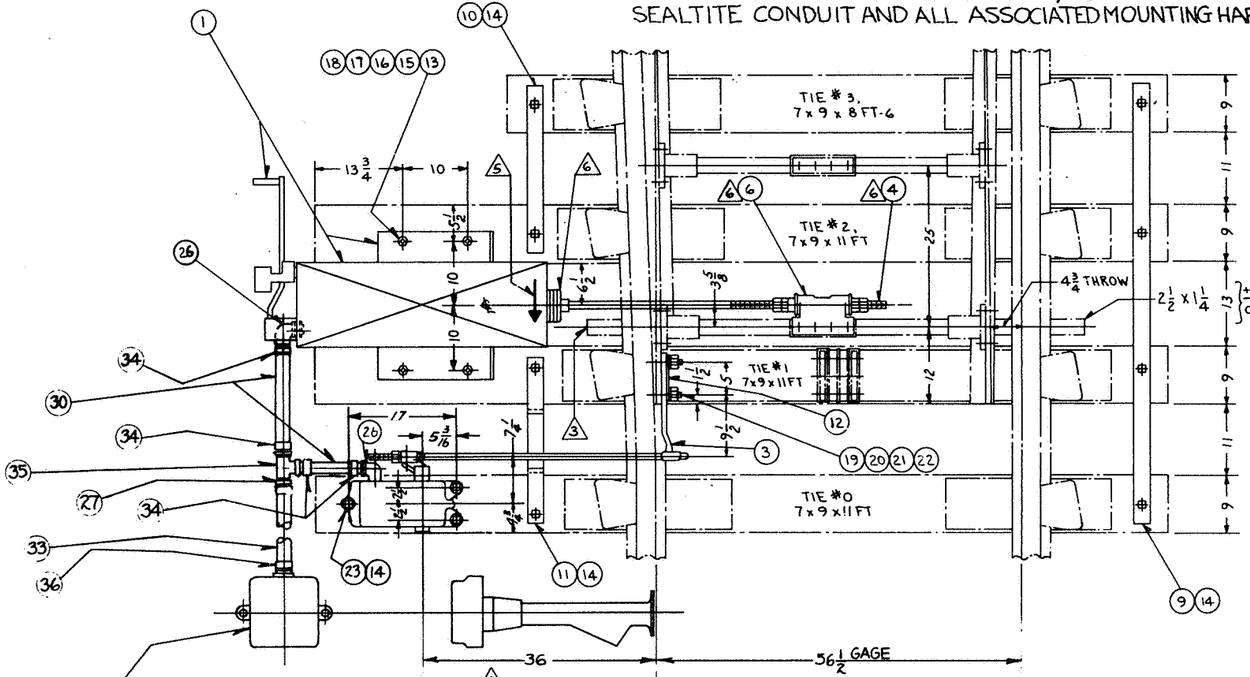
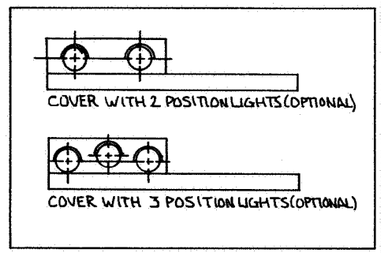


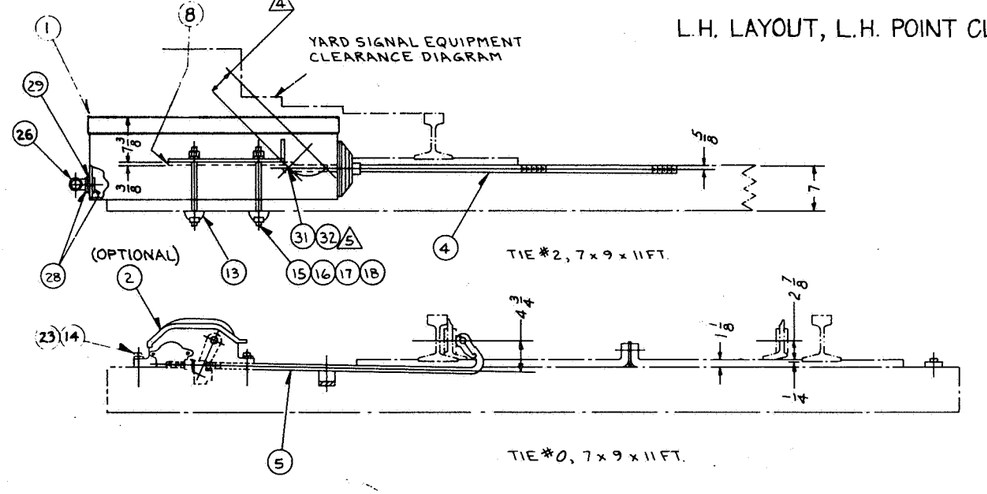
Figure 8-1. Timing Diagram

TYPICAL LAYOUT WITH OPTIONAL U-5 CIRCUIT CONTROLLER AND JUNCTION BOX, INCLUDING SEALTITE CONDUIT AND ALL ASSOCIATED MOUNTING HARDWARE


TIE *3, 7 x 9 x 8 FT-6
TIE *2, 7 x 9 x 11 FT
TIE *1 7 x 9 x 11 FT
TIE *0 7 x 9 x 11 FT
4¾ THROW
2½ x 1¼
±1/8 THIS DIM FOR CLEARANCE OF MACH
13¾
10
36
56½ GAGE
(OPTIONAL)

L.H. LAYOUT, L.H. POINT CLOSED





ITEM NUMBER	GROUP-U M	QUANTITY UNITS	QUANTITY DEC.	PART IDENTIFICATION T	PART IDENTIFICATION NUMBER	PART IDENTIFICATION SUFFIX	DESCRIPTION	DRAWING T	DRAWING NUMBER	DRAWING SHEET
				x				D		
1	1	1.		N	451613	XXX	MACHINE, YM-4 SWITCH	R	451613	01
2	1	1.		N	184136		CONTROLLER, U-5	F	80065	1
3	1	1.		M	346593		LUG, POINT DET	B	8060	225
4	1	1.		N	280117		ROD, OPER	C	50041	6
5	1	1.		N	224218		ROD, CIR CONT OPER	B	10287	115
6	1	1.		N	190835		ADJUSTER, SW PT	B	8060	53
7		1.		N	374993		BOX, JUNCTION	D	66316	6
8	1	2.		M	451517	0602	SHIM PLATE, YM-4 (3/8)	C	451517	06
9	1	1.		M	256405		STRAP, TIE	C	50052	8
10	1	1.		M	127876		STRAP, TIE	C	50052	6
11	1	1.		M	280739		STRAP, TIE	B	9613	68
12	1	1.		M	286994		PLATE	B	5542	25
13	1	4.		M	199406		WASHER, C.I. (3/8)		8065	206
14	1	11.		J	050347		SCREW, 3/4 x 6 LAG			
15	1	4.		M	386874		STUD, 3/4 x 11-3/4 STL	B	35043	2
16	1	4.		J	048026		NUT, 3/4 HEX STL			
17	1	4.		J	048229		NUT, 3/4 SQ STL			
18	1	4.		J	047772		WASH, 3/4 LOCK STL			
19	1	2.		M	244552		BOLT, 1" x 4 3/8 SQ.		8479	269
20	1	2.		J	048030		NUT, 1" HEX STL			
21	1	2.		J	047774		WASH, 1" LOCK STL			
22	1	2.		J	048643		COT, 1/4 x 1-1/2 STL			
23	1	3.		J	047506		WASH, 3/4 PLATE STL			
24										
25										
26		2.		J	032488		ELL, 1 1/2 GALV STREET			
27	1	1.		J	690952		CONN, 2" SEALTITE			
28	1	2.		J	048417		NUT, LOCK 1-1/2 CNDT			
29	1	1.		J	470075		GASKET - 1-1/2" PIPE			
30		2.		M	451569	0102	COND-1 1/2 SEALTITE (26)	B	451569	01
⑤ 31	1	1.		M	022589	001	PIN	B	010338	1
32	1	1.		J	048634		COTTER, 3/16 x 1 1/2 STL			
33	1	1.		M	451569	0301	COND-2" SEALTITE (27)	B	451569	03
34	1	4.		J	323152		CONN-1 1/2 SEALTITE			
35	1	1.		J	330260		TEE-2"x1 1/2 x1 1/2			
36	1	1.		X	438108		CONN-2" SEALTITE	D	66316	28

NOTES:

1. PARTS SHOWN IN FULL LINES TO BE FURNISHED BY US & S.

③ CUT FOUR (4) INCHES FROM SWITCH END OF SWITCH ROD NO. 1, PRIOR TO INSTALLATION, TO OBTAIN ADEQUATE CLEARANCE.

④ FOR 5¾ THROW OF MACHINE SET EYEBOLT @ 4 1/16 IF ANY VARIENCE OF THROW IS REQ. SEE SERVICE MANUAL.

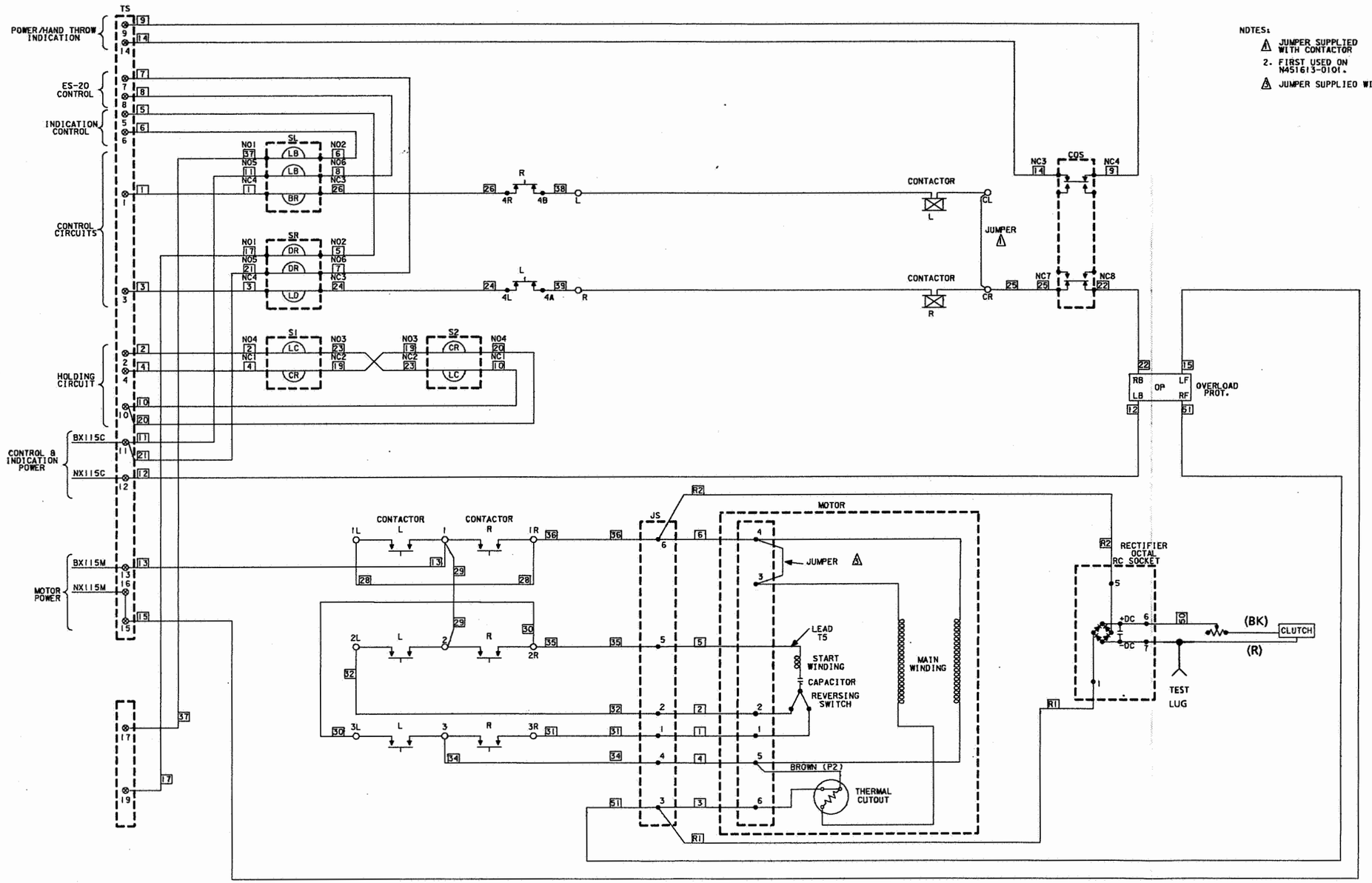
⑤ PIN (ITEM 31) CAN ONLY BE INSTALLED IN ONE DIRECTION, LOCATE PIN PER PLAN VIEW OF MACHINE.

⑥ BEFORE PLACING SWITCH MACHINE & ASSEMBLING OPERATING ROD, BELLOWS & SWITCH POINT ADJUSTER, REFER TO INSTRUCTION MANUAL 6231 FOR OPER INSTRUCTIONS.

⑦ JUNCTION BOX (ITEM 7) TO BE LOCATED TO SUIT FIELD CONDITIONS.

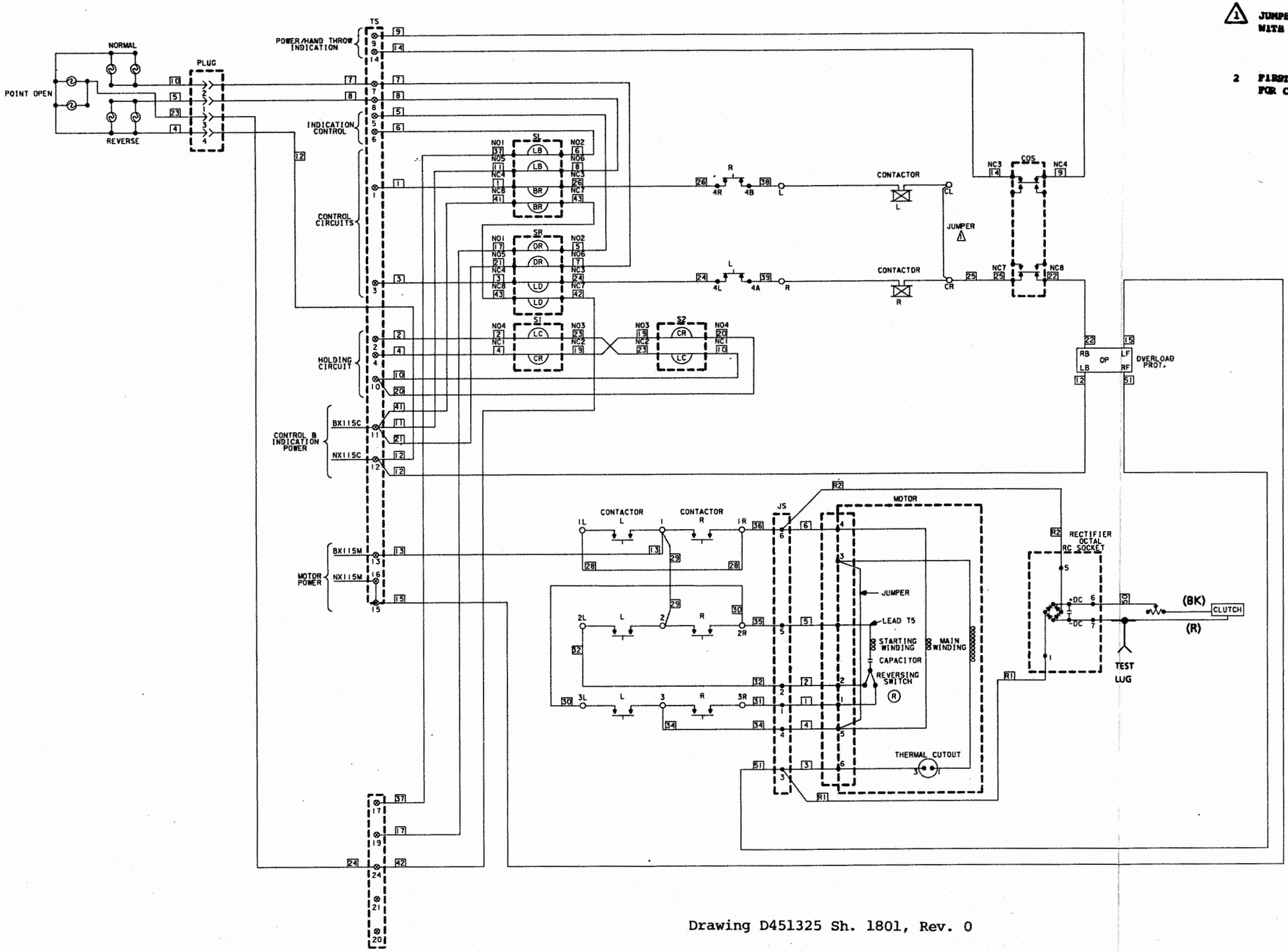
Drawing D451567 Sh. 81, Rev. 0

Figure 8-2. Typical Layout, RH or LH YM-4 Switch Machine Applied to Insulated 16'-6" Single Split Switch, #15 Turnout



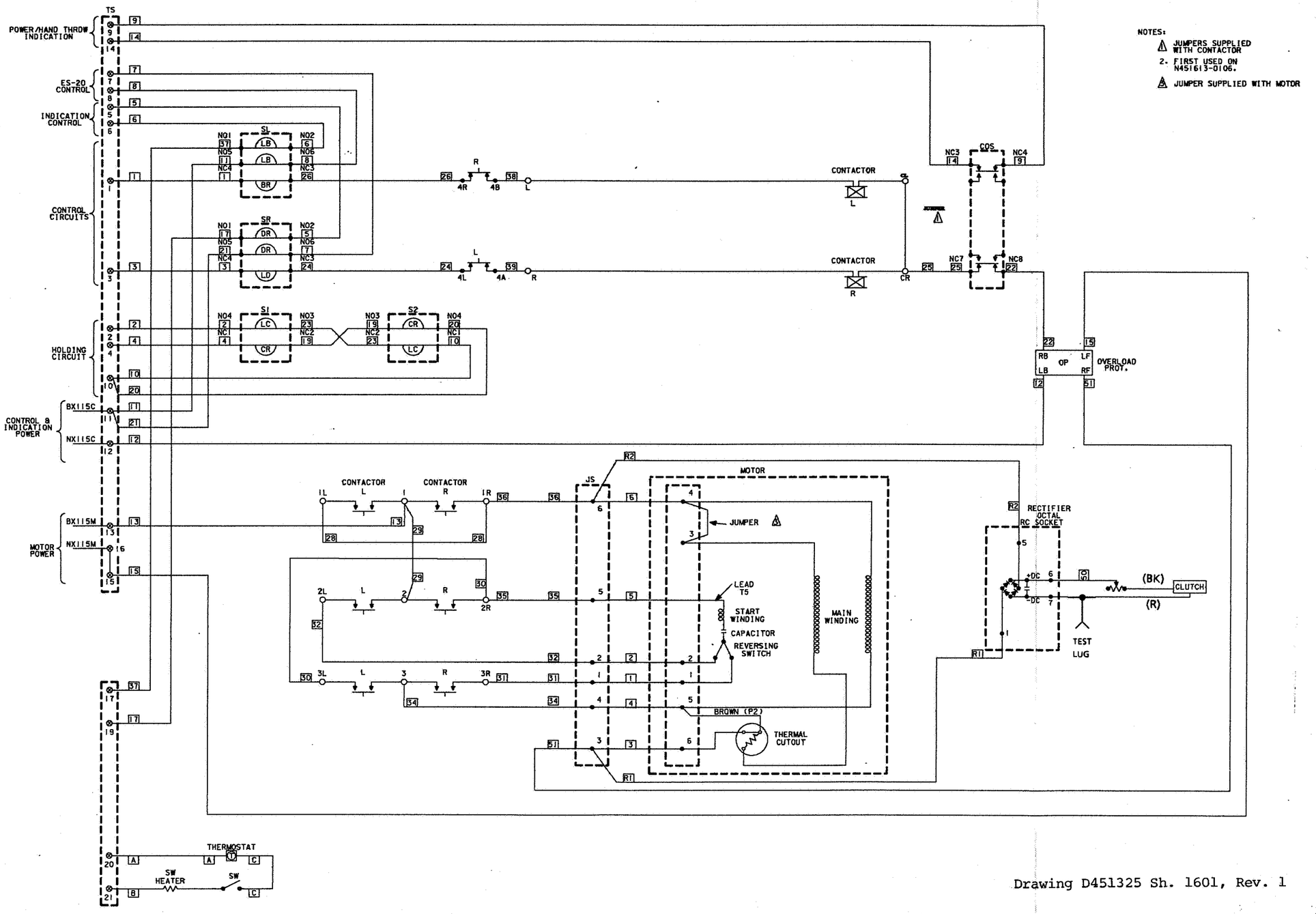
Drawing D451325 Sh. 1201, Rev. 4

Figure 8-3. Typical Circuit Diagram for 115 VAC Machine, 115 VAC Control



Drawing D451325 Sh. 1801, Rev. 0

Figure 8-4. Typical Circuit Diagram for 115VAC Machine, 115VAC Control



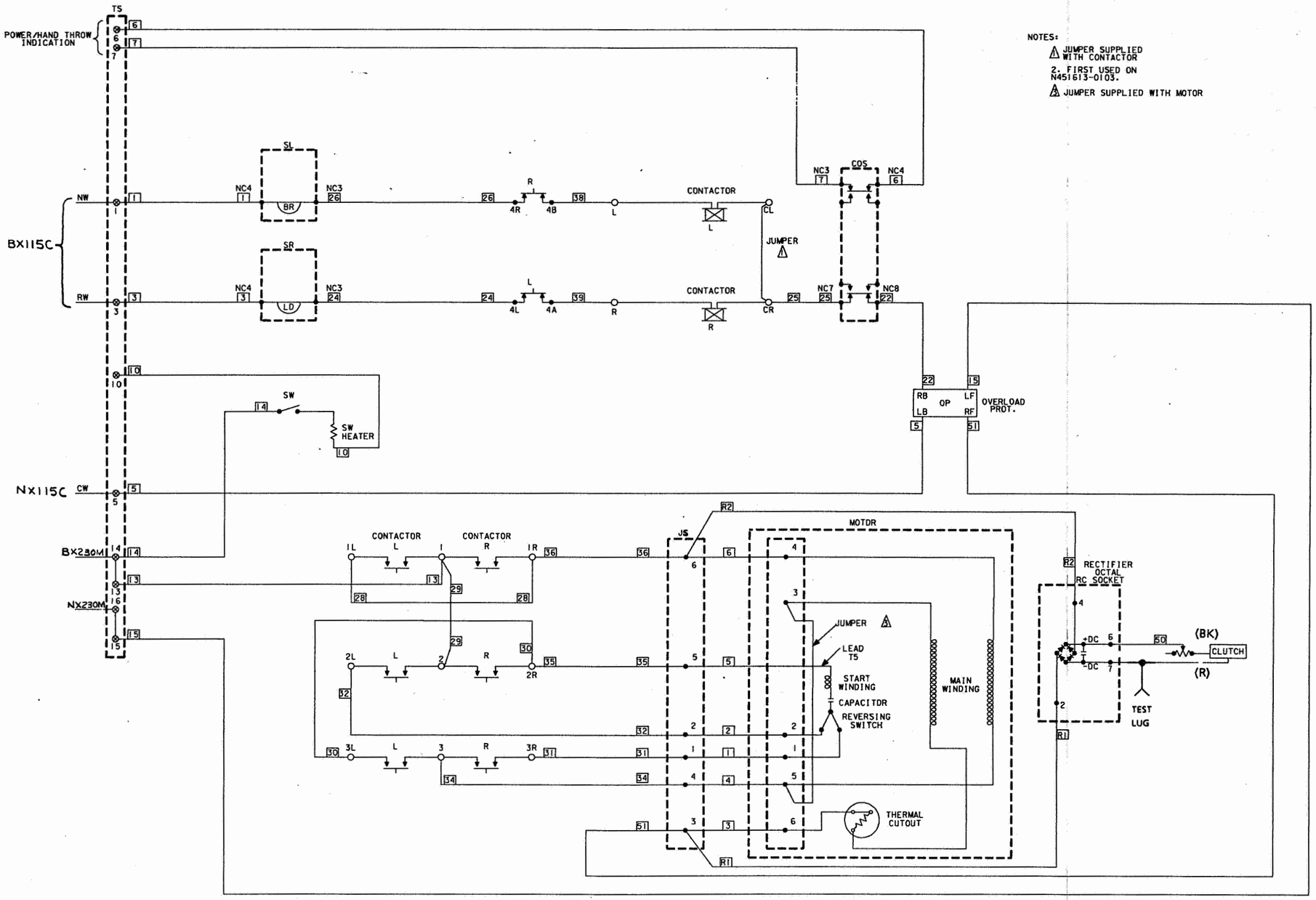
NOTES:

1. ⚠ JUMPERS SUPPLIED WITH CONTACTOR
2. FIRST USED ON N451613-0106.

⚠ JUMPER SUPPLIED WITH MOTOR

Drawing D451325 Sh. 1601, Rev. 1

Figure 8-5. Typical Circuit Diagram for 115 VAC Machine, 115 VAC Control

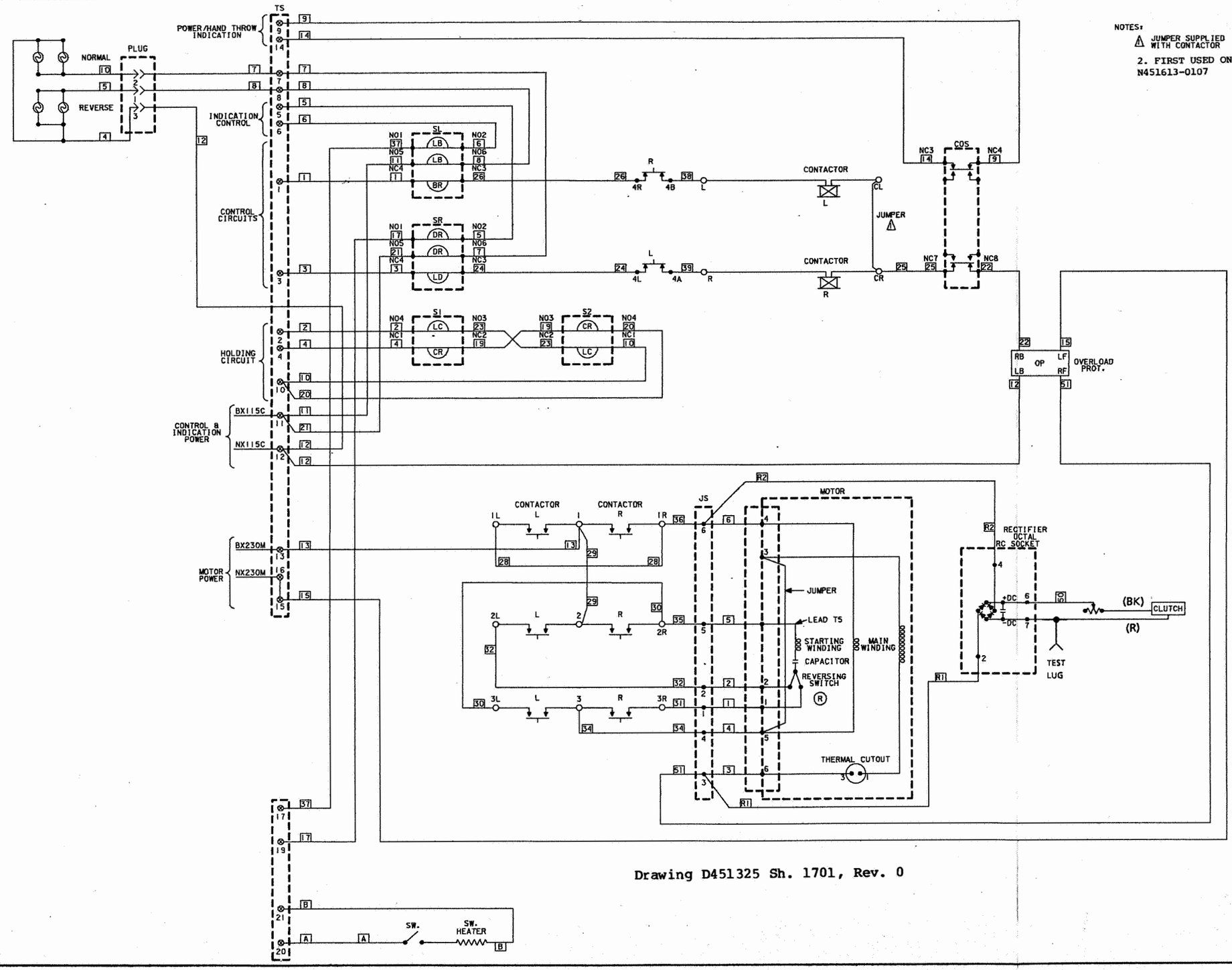


NOTES:

1. ⚠ JUMPER SUPPLIED WITH CONTACTOR
2. FIRST USED ON N451613-0103.
3. ⚠ JUMPER SUPPLIED WITH MOTOR

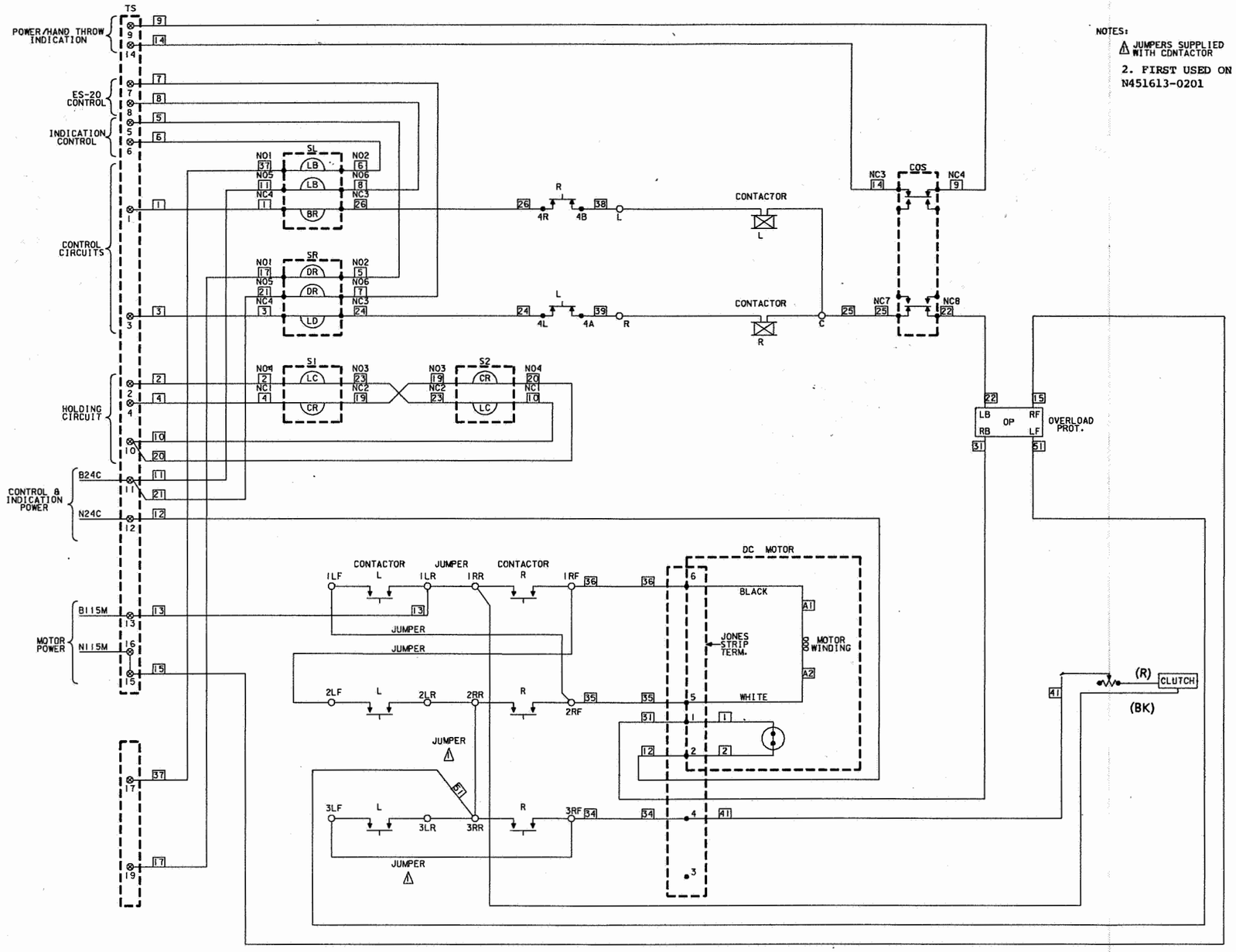
Drawing D451325 Sh. 1301, Rev. 1

Figure 8-6. Typical Circuit Diagram for 230 VAC Machine, 115 VAC Control



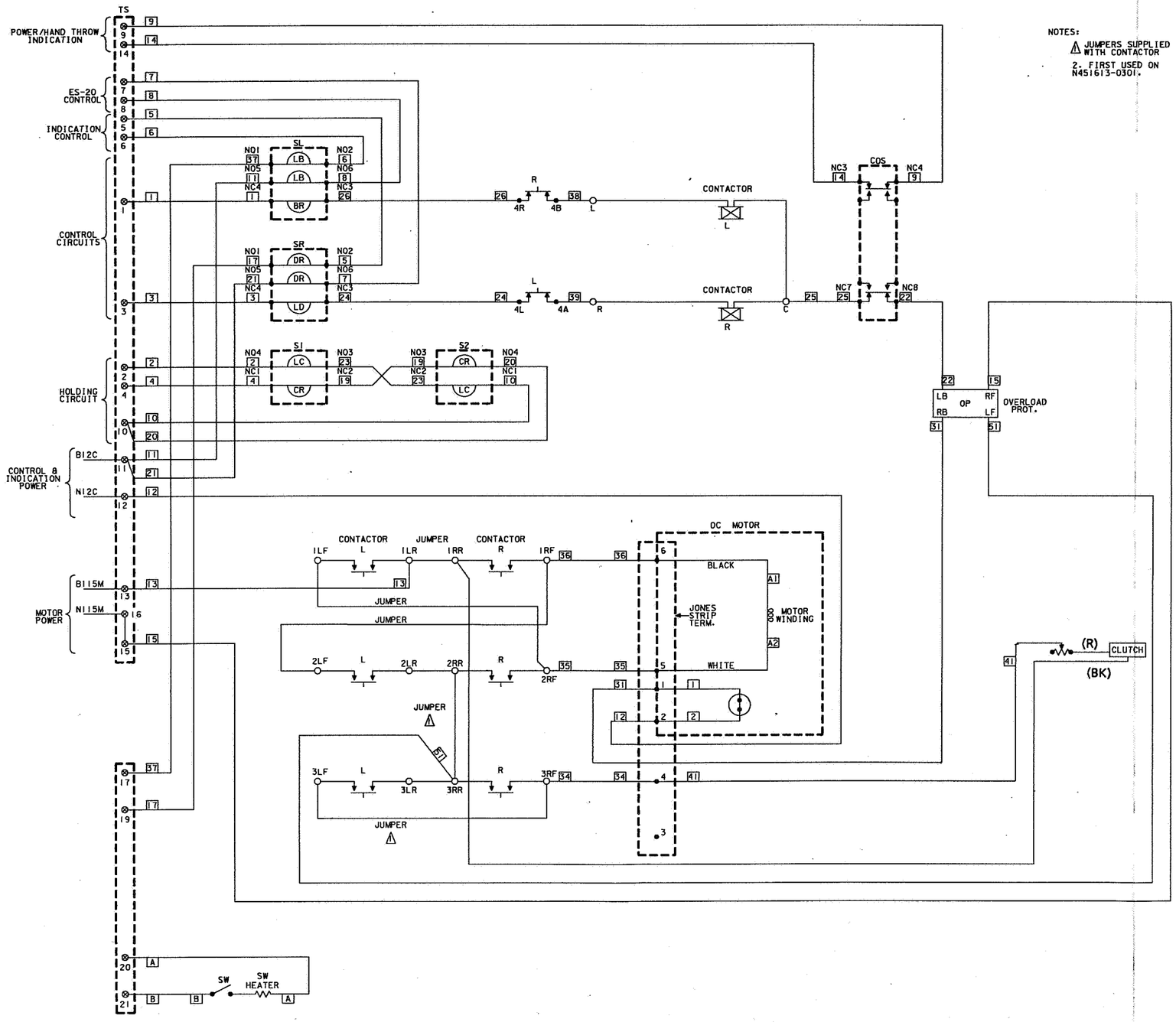
Drawing D451325 Sh. 1701, Rev. 0

Figure 8-7. Typical Circuit Diagram for 230 VAC Machine, 115 VAC Control



Drawing D451325 Sh. 1401, Rev. 2

Figure 8-8. Typical Circuit Diagram for 115 VDC Machine, 24-28 VDC Control



Drawing D451325 Sh. 1501, Rev. 0

Figure 8-9. Typical Circuit Diagram for 115 VDC Machine, 12 VDC Control

SERVICE MANUAL 6231
Appendix A

Parts List

ELECTRIC SWITCH MACHINE
YM-4
DUAL CONTROL, TRAILABLE

FOR SWITCH MACHINES MANUFACTURED AFTER JANUARY 1, 1984

THIS MANUAL SUPERSEDES SM-6231 DATED OCTOBER, 1982

November, 1986 (Rev. 1/87)
ID1149A/DN0007A
D-11/87-75-2430-3

UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD INC / PITTSBURGH, PA 15237

YM-4 SWITCH MACHINE ASSEMBLIES

Motor/Control Power	Indication Lights	US&S Part No.	Code
115 V AC/115V AC Control	--	N451613-0101	A
115 V AC/115V AC Control	Green/Yellow (Glass)	N451613-0102	B
230 V AC/115V AC Control	--	N451613-0103	C
115 V AC/115V AC Control	Lunar White/Red (Plastic)	N451613-0104	D
115 V AC/115V AC Control	Green/Yellow (Plastic)	N451613-0105	F
115 V AC/115V AC Control	Green/Yellow (Glass)	N451613-0106	G
230 V AC/115V AC Control	Green/Yellow (Plastic)	N451613-0107	I
115 V AC/115V AC Control	Red/Yellow/Green (PLastic)	N451613-0108	J
115 V AC/24-28V DC Control	Green/Red/Yellow (Plastic)	N451613-0109	K
115 V AC/12V DC Control	--	N451613-0110	L
230 V AC/115V AC Control	Green/Red/Yellow (Glass)	N451613-0111	M
115 V AC/115V AC Control	Green/Red (Glass)	N451613-0112	N
115 V DC/24-28V DC Control	--	N451613-0201	E
115 V DC/12V DC Control	--	N451613-0301	H
115 V DC/12V DC Control	Green/Yellow (Glass)	N451613-0302	O

YM-4 SWITCH MACHINE ASSEMBLY PARTS LIST
Part No.'s 451613-0101, -0XXX
(See Figure A-1)

Item	Description	Part No.	Used On Code
1	Case	R451614-0902	All
2	Cover	N451614-1402	A,C,E,H,L
	Cover, with Position Indicating Lights (See Figure A-6)	N451614-4401	B,G,O
	Cover Assembly	N451614-4402	D
	Cover Assembly	N451614-4403	F,I
	Cover Assembly	N451614-4405	N
	Cover Assembly	N451614-7001	J,K
	Cover Assembly	N451614-7002	M
3	Plug, Pipe 3/14-14 NPT	J032906	All
4	120 Gear Box and Motor Assembly (See Fig. A-3)	N451614-6001	A,B,D,F,G, J,K,L,N
	Gear Box and Motor Assembly (See Figure A-3)	N451614-6002	C,I,M
	Gear Box and Motor Assembly (See Figure A-2)	N451614-6101	E,H,O
5	Bolt, 3/8-16 x 1-1/4 Hex. Hd	J050056	All
6	Washer, LK. 3/8	J475121-0113	All
7	Pin Dowel	J703412	All
8	Spring, Toggle (See Figure A-4)	N451614-0401	All
9	Pin, Spring Block	M451614-2303	All
10	Pin, Toggle Spring	M451614-2302	All
11	Bolt, 1/2-13x1-3/4 Hex. Hd	J050095	All
12	Washer, LK. 1/2	J047783	All
13	Pin, Cotter 1/4 x 2	J048645	All
14	Shaft, Output Crank (See Figure A-5)	N451614-0501	All except C
14	Shaft, Output Crank	N451614-0503	C
15	Plate, Crank Shaft Mtg.	R451614-0103	All

Item	Description	Part No.	Used On Code
16	Shim	M451614-0104	All
17	Bolt, 3/8-16x1" Hex. Hd.	J050053	All
18	Washer, LK 9/16	J475209	All
19	Screw, 10-32 x 5/16 RD	J052562	E,H
20	Trough, Wire	M451614-3205	All
21	Pin, Hinge	N451614-3105	All
22	Brkt. Limit Sw. Mtg.	M451614-3204	All
23	Bolt, 1/4-20 x 5/8 Hex. Hd.	J050013	All
24	Washer, LK 1/4	J047775	All
25	Nut, 1/4-20 Hex.	J048203	All
26	Bolt, 1/4-20x1 Hex. Hd.	J050019	All
27	Brkt., Limit Switch	M451614-3202	All
28	Brkt., Limit Switch	M451614-3203	All
29	Switch Limit	J725666	All except C
30	Switch Limit	J725707-0193	All
31	Insulators	M451614-3208	All except C
32	Bellows	J751327	All
33	Plate, Bellows Mtg.	M451614-3601	All
34	Bolt, 1/4-20 x 1-1/4 Hex. Hd.	J050021	All
35	Nut, 1/4-20 Hex.	J048002	All
36	Washer, 1/4 PL.	J047501	All
37	Support, Lever Cam Shaft	R451614-1802	All
38	Bolt, 3/8-16 x 1-1/2 Hex. Hd.	J050057	All
39	Lever, Hand Throw	R451614-3403	All
40	Washer, LK 1"	J047823	All
41	Stud, Lever	M192069	All
42	Lever, Interlocking	N451614-2108	All
43	Bolt, 5/8-11 x 3-1/4 Hex. Galv.	M451614-2107	All
44	Nut, 5/8-11 Slotted Hex	J048074	All
45	Washer, 5/8 Pl. Brass	J475189	All
46	Washer, LK 5/8	J047822	All
47	Latch, Hand Throw	N451614-3001	All
48	Nut	M451614-3102	All
49	Pin, Cotter 1/8 x 1" Stl.	J048620	All
50	Bushing	M451393-0701	All
51	Bolt, 1/2-13 x 1-1/4 Hex. Hd.	J050090	All
52	Brkt. Cut-out Sw. Mtg.	M451614-3201	All except G
	Brkt. Cut-out Sw. Mtg.	M451614-5801	G
53	Screw, 4-40 x 1-1/2 Rdh. St.	J525093	All
54	Contactor, Motor Rev.	J706448	A,B,C,D,F,G, I,J,M,N
	Contactor - 24 VDC Coils	J709599	E,K
	Contactor - 12 VDC Coils	J709599-0001	H,L,O
55	Screw, 10-32 x 5/8 RDH	J052566	All
56	Strip, Term. AAR 12 pole	J077653	All
57	Strip, Term. AAR 4 pole	M107471	All
58	Connector, Term. Strip	M451614-3206	All
59	Brkt. Term. Strip Mtg.	M451614-3207	C
	Brkt. Term. Strip Mtg.	M451614-3209	All except C

Item	Description	Part No.	Used On Code
60	Screw, 10-32 x 7/8 Fil. Hd.	J052299	All
61	Nut, 10-32 Hex. Stl.	J048172	All
62	Washer LK #10	J047733	All
63	Screw, #10-32 x 3/8 RDH	J052564	All
64	Nut, AAR	J480301	All
65	Nut, AAR Jam	J480300	All
66	Washer, AAR	J047818	All
67	Nut, Insulating	J048300	All
68	Strip, Jones Term.	J724351	All
69	Protector, Overload	J726153-0016	All
70	Heater	J713154-0004	A,B,D,F,G,J,L,M,N
	Heater	J713154-0006	I,C
	Heater	J713154-0005	E,H,K,O
71	Resistor, 2K ohms 25 Watt	J073817	A,B,D,E,F,G,H,J, K,L,N,O
	Resistor, 7.5K ohms 25W	J735519-0616	C,I,M
72	Harness	N451614-3801	A,B,D,F,N
	Harness	N451614-5201	C
	Harness	N451614-4901	E
	Harness	N451614-5701	G
	Harness	N451614-5501	H,O
	Harness	N451614-5901	I
	Harness	N451614-7101	J,M
	Harness	N451614-7701	K
	Harness	N451614-7901	L
73	Washer, #8 Shakeproof LK	J047892	All
74	Lead	N438713-001	A,B,C,D,F,G,I,J,M,N
75	Clamp, Trough	N451614-4806	All
76	Spring	M451614-4803	A,B,D,F,G,J,K,L,N
	Spring	M451614-4804	C,I,M
77	Test Link	J071626	All
78	Nut, 9/16-18	J480315	All
79	Lead	N438431-007	A,B,C,D,F,G,I,J,M,N
80	Screw, 6-32 x 1/4 Rd. Hd. Stl.	J525055	All
81	Screw, 6-32 x 1 Rd. Hd.	J525097	A,B,C,D,F,G I,J,K,L,M,N
82	Term., Ins. Faston 250	J731443	All
83	Term., Amp (#6 Post)	J730077	All
85	Clamp	J709590	All
86	Screw, #3-48 x 3/4 Rd. Hd.	J525234	All
87	Ventilator	N070109	All
88	Cap, Plug	J703392	All
90	Power Supply	J725709-0070	A,B,D,F,G,J,K,L,N
	Power Supply	J725709-0085	C,I,M
91	Socket, Octal	J792847	A,B,C,D,F,G,I,J, K,L,M,N
92	Spiral Pin	J487318	All
94	Cover, Gear Box	M451614-6601	All

Item	Description	Part No.	Used On Code
95	Resistor, 800 ohms 30 Watt	J720074	C,G,H,I,O
96	Nut, Jam 3/8-16	J048010	All
97	Nut, 1/4-20 Hex. Stl.	J048631	All
98	Heater Plate-Name	M451607-7101	C,G,H,I,O
99	Lubricant, Stazon-M	A041477	All
100	Spacer	M451614-2106	All
101	Pin, Cotter 3/16 x 1-1/2 Stl.	J048634	All
102	Ties, Cable	J703360	All
103	Shim	M451614-0105	All
104	Screw, 1/4-20 x 7/8 Hex.	J050017	All
105	Screw, 10-32 x 1/2 In. Rd	J052565	All
106	Plate, Cont. Adapter	M451614-5103	All except G
	Plate, Cont. Adapter	M451614-5105	G
107	Screw, 10-32 x 1/4 Rd.	J052563	All
108	Washer, 6 Shprf. Lk.	J047713	All
109	Switch, 6-amp 125V SP ST	J724515	C,G,H,I,O
110	Lead	M438876	C,G,H,I,O
111	Label (Not Shown)	M451523-2501	C
113	Stud, Hasp	M387732	All
114	Screw, 3/8 x 1-1/2 Hex. Hd.	J050057	All
115	Pin-Roll Elas. Stp. Nt.	J487025	All
116	Washer	M391200	All
117	Hasp	N072832	All
118	Washer, 10 Shprf. Lk	J047715	All
119	Washer, 10 Flt. Stl. Coml.	J475077	A,B,C,D,F,G,I,J,M,N
120	Clamp, Cable	J709556	All
121	Bracket, Standoff	M451614-5603	All
122	Grommet, Rubber	J075487	All
123	Insulator, Overload Protector	J780059	All
124	Tubing, Spiral Wrap Black	A774186	All
125	Strip, Term. AAR 8 Pole	M223608	All except C
126	Thermostat	J620940	G
127	Washer, 10 Stl. Lk	J047733	G
128	Screw, 10-32 x 3/16 Rd. Hd.	J052561	G
129	Cable Clamp	J700651	G
131	Screw, 8-32 x 3/16 Rd.	J052601	G
132	Shim, Top and Bottom	M451174-0601	All
133	Shim, Side	M451174-0701	All

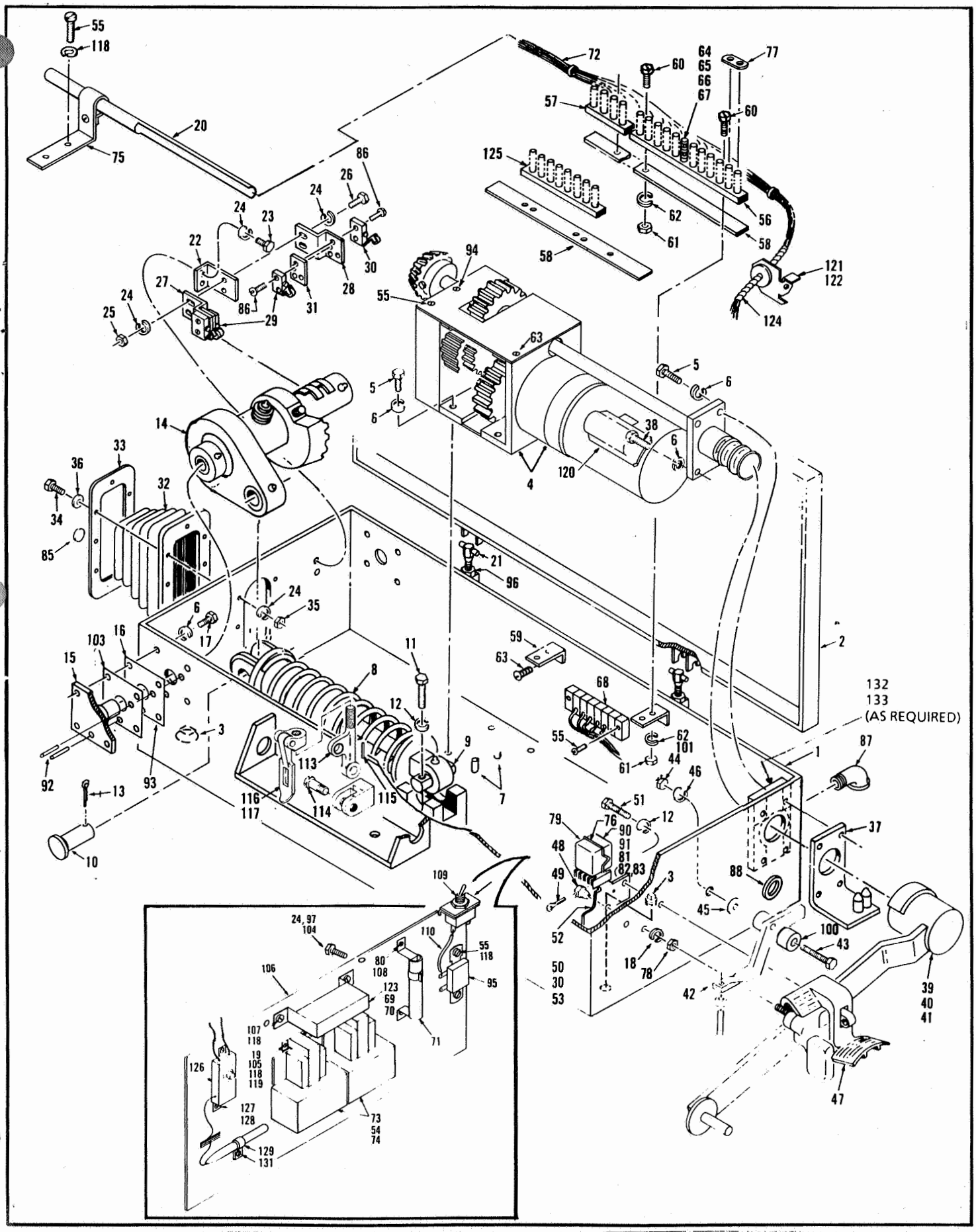


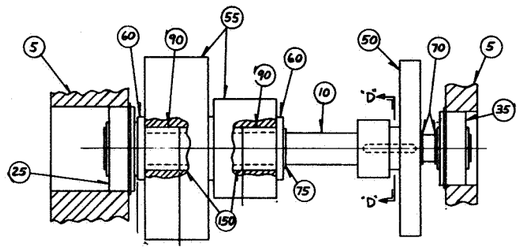
Figure A-1. YM-4 Electric Switch Machine, Exploded View

GEAR BOX AND MOTOR ASSEMBLY PARTS LIST
Part No. N451614-6101
(See Figure A-2)

Item	Description	Part No.
5	Frame, Gear Box	N451614-6301
10	Shaft, Gear Box	M451614-1701
15	Shaft, Gear Box	N451614-1702
20	Shaft, Gear Box	M451614-1703
25	Bearing, Ball Single Row	J066419
30	Bearing, Ball Single Row	J066418
35	Bearing, Ball Single Row	J066417
40	CUP, BRG Single Row	J066420
45	Bearing, Cone Single Row	J066421
50	Gear	M451614-2501
55	Gear	M451614-2504
60	Washer	M451614-3510
65	Screw, 3/8 x 1-1/4 Hex HD	J050056
70	Ring, Retaining Snap Ext.	J792852
75	Ring, Retaining Snap Ext.	J792853
80	Ring, Retaining Snap Ext.	J792854
85	Gear	M451614-2503
90	Bearing, Needle RLR Cage	J066416
95	Key	M451614-3504
100	Key	M451614-3505
105	Key	M451614-3506
110	Gear	M451614-2502
115	Ring, Retaining Bowed Ext.	J792849
120	Module-Elect. Clutch	J792843
125	Motor-Perm. Mag. 115V	J717250
130	Gear	M451614-2505
135	Screw, 1/4 x 1/4 SAF Set	J050500
140	Washer, 3/8 Stl. LK Med.	J475121-0113
145	Grommet	J751127
150	Spacer	M451614-3511
155	Terminal PR-INSUL DMDGRP	J730053
160	Card, Quik Label Code	J063646-0001
165	Card, Quik Label Code	J063646-0002
170	Bushing, Insul. 1/2"	J690429
175	Gear, Bevel	M451614-2701
180	Key	M451614-3508
185	Nut, 3/8-16 Hex. Jam	J048010
190	Screw, 3/8-16 x 1-1/4 Hex. Hd.	J046428
195	Washer, Lock	J047786
200	Nut, Lock	J048573
205	Shaft, Hand Throw	R451614-6402
210	Bearing, Ball	J066368
215	Ring, Retaining	J790344
220	Washer	M451614-3503
225	Ring, Retaining	J079388

GEAR BOX AND MOTOR ASSEMBLY PARTS LIST (Cont'd.)

Item	Description	Part No.
230	Gear	M451614-2506
235	Key	M451614-3507
240	Bushing	M451593-0203
245	Ring, Retaining	J792964
250	Block, Lever Bearing	R451614-2203
255	Spacer	M451614-3513
260	Ball Bearing	J066426



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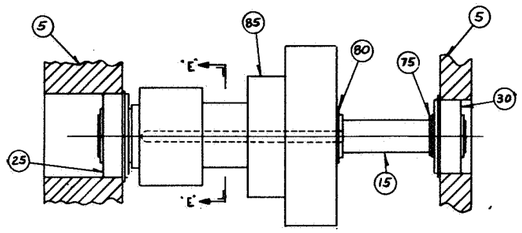

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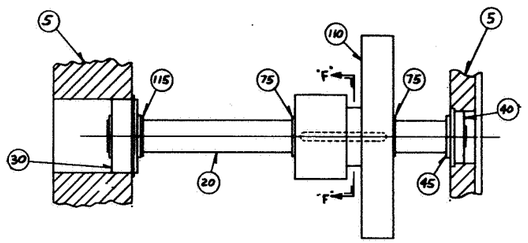
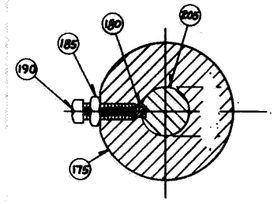


VIEW "C"



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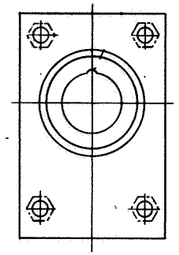

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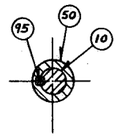

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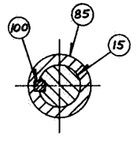

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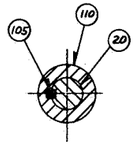

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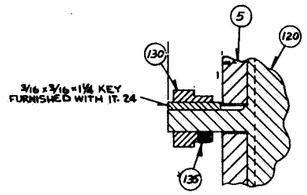
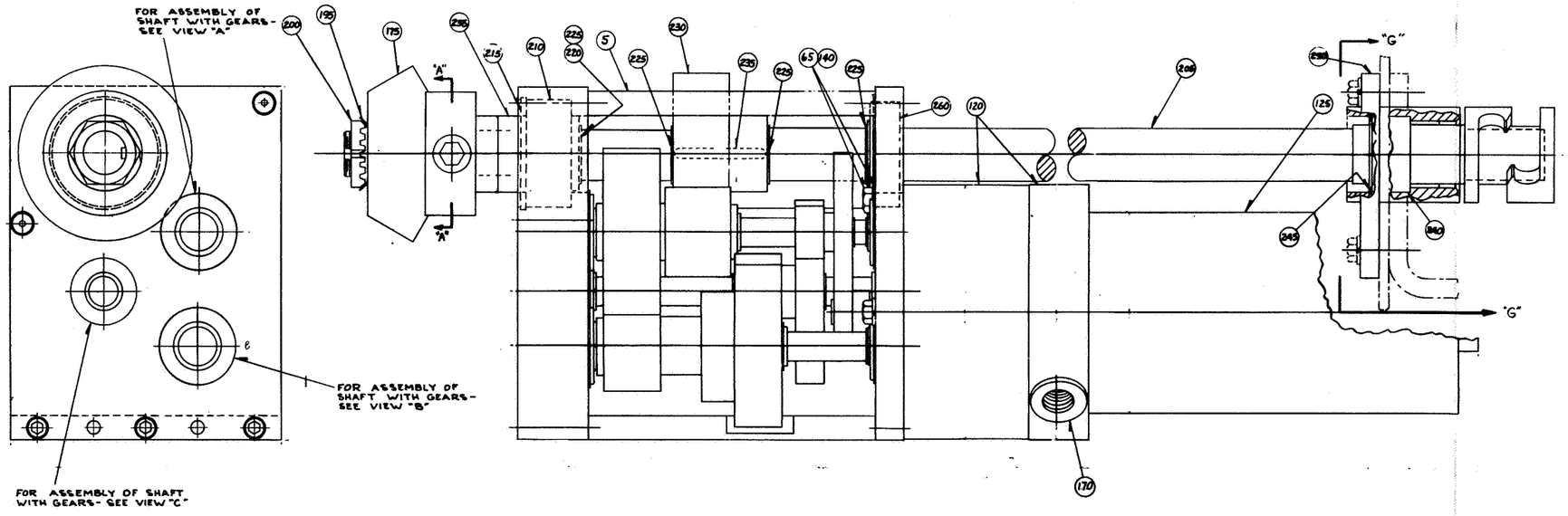
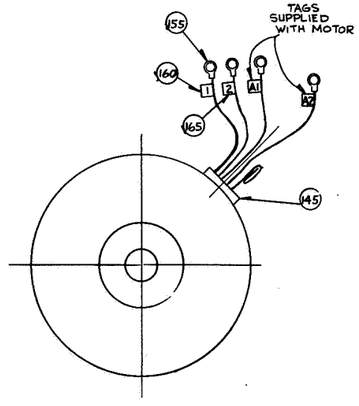


VIEW SHOWING MOUNTING OF PINION GEAR ON CLUTCH MODULE





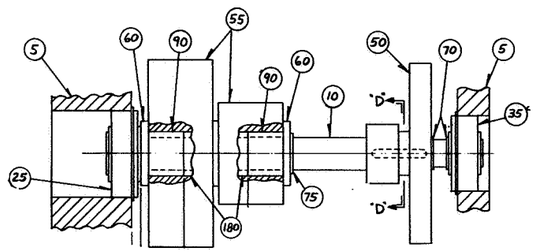
Drawing F451614 Sh. 61, Rev. 1

Figure A-2. Gear Box and Motor Assembly

GEAR BOX AND MOTOR ASSEMBLY PARTS LIST
Part Nos. N451614-6001 & -6002
(See Figure A-3)

Item	Description	Part No.
5	Frame, Gear Box	N451614-6301
10	Shaft, Gear Box	N451614-1701
15	Shaft, Gear Box	N451614-1702
20	Shaft, Gear Box	N451614-1703
25	Bearing, Ball Single Row	J066419
30	Bearing, Ball Single Row	J066418
35	Bearing, Ball Single Row	J066417
40	Cup, Bearing Single Row	J066420
45	Bearing, Cone Single Row	J066421
50	Gear	M451614-2501
55	Gear	M451614-2504
60	Washer	M451614-3510
65	Screw, 3/8 x 1-1/4 Hex Hd.	J050056
70	Ring, Retaining Snap Ext.	J792852
75	Ring, Retaining Snap Ext.	J792853
80	Ring, Retaining Snap Ext.	J792854
85	Gear	M451614-2503
90	Bearing, Needle RLR Cage	J066416
95	Key	M451614-3504
100	Key	M451614-3505
105	Key	M451614-3506
110	Gear	M451614-2502
115	Ring, Retaining Bowed Ext.	J792849
120	Module, Electro Clutch	J792843
125	Motor, 1 HP 115/230Vac	J717245-0001
130	Gear	M451614-2505
135	Screw, 1/4 x 1/4 SAF Set	J050500
140	Washer, 3/8 Stl. LK Med.	J475121-0113
145	Grommet	J751127
150	Lead	N438713-003
155	Lead	N438713-004
160	Lead	N438713-005
165	Lead	N438713-006
170	Lead	N438713-007
175	Lead	N438713-008
180	Spacer	M451614-3511
185	Bushing, Insulating 1/2"	J690429
190	Gear, Pinion Bevel	M451614-2701
195	Key	M451614-3508
200	Nut, 3/8-16 UNC-28 Jam	J048010
205	Screw, 3/8-16 x 1-1/4 Hex Hd.	J046428
210	Washer, W-06 SKF Lock	J047786
215	Nut-N-06 SKF LK	J048573
220	Shaft, Hand Throw	R451614-6402
225	Bearing, Ball DBl w/Seals	J066368
230	Rings, Waldes Retaining	J790344
235	Washer	M451614-3503

Item	Description	Part No.
240	Ring, External Ring	J079388
245	Gear	M451614-2506
250	Key	M451614-3507
255	Bushing	M451393-0203
260	Ring, Internal Ring	J792964
265	Block, Lever Bearing	R451614-2203
270	Spacer	M451614-3512
280	Tubing, Heat Shink 3/16 ID	A774169
285	Bearing, Ball Single Row	J066428



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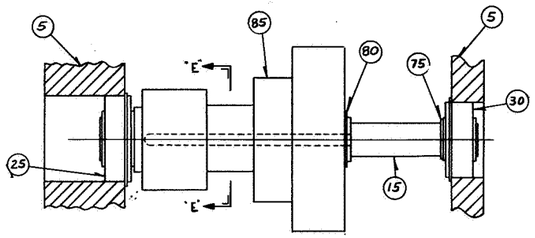
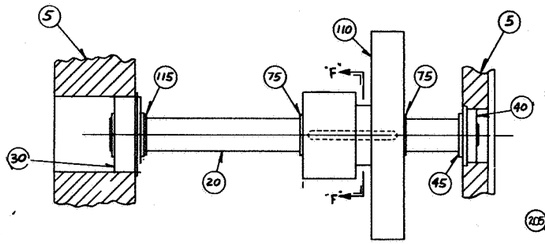


VIEW "B"



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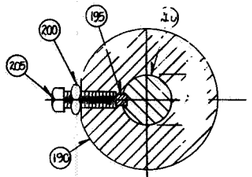

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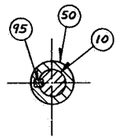

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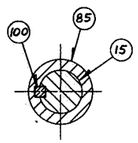

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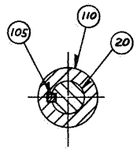

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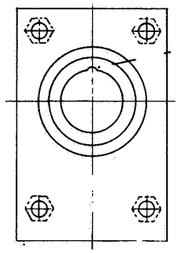

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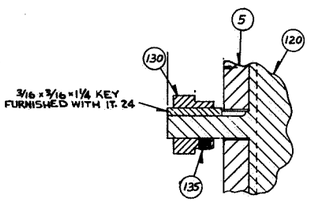
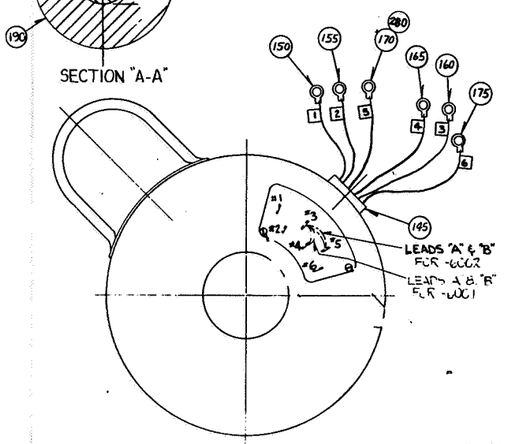
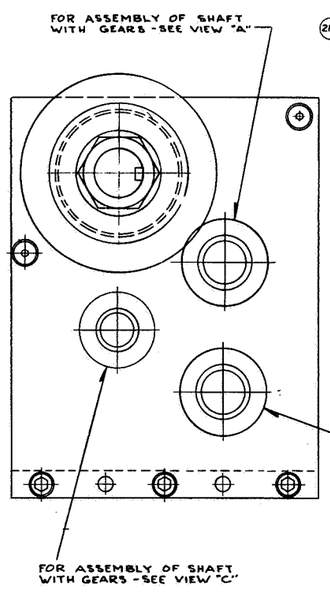
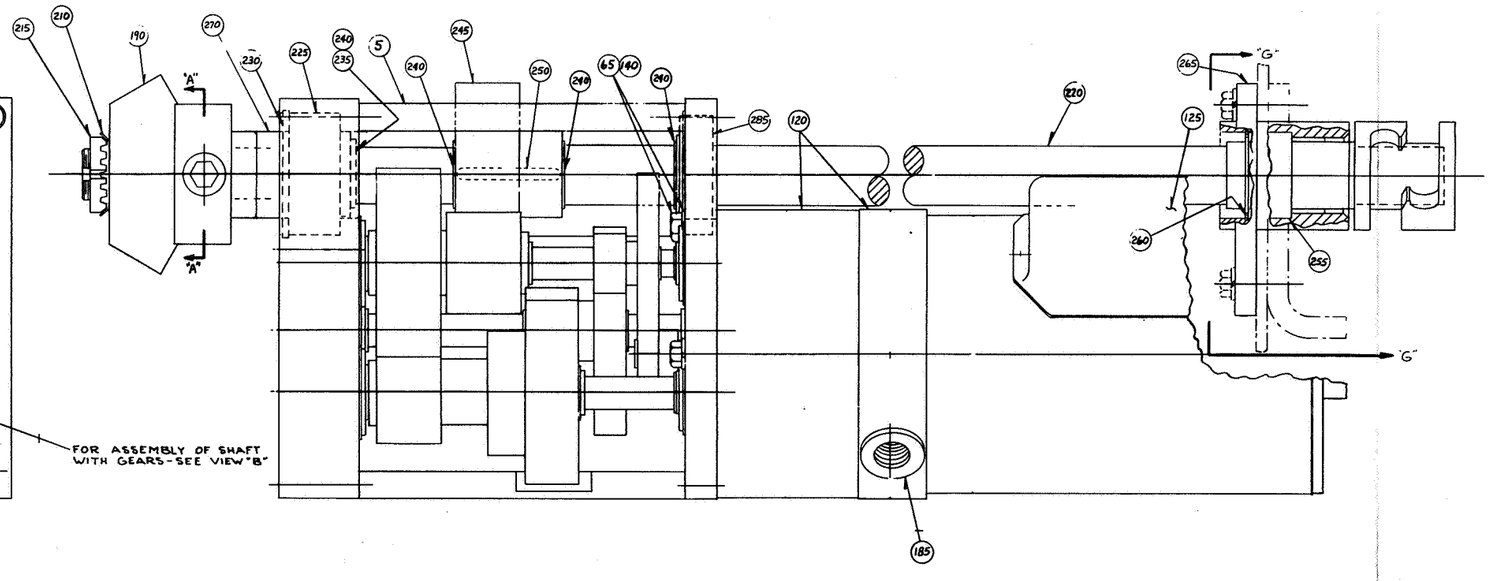


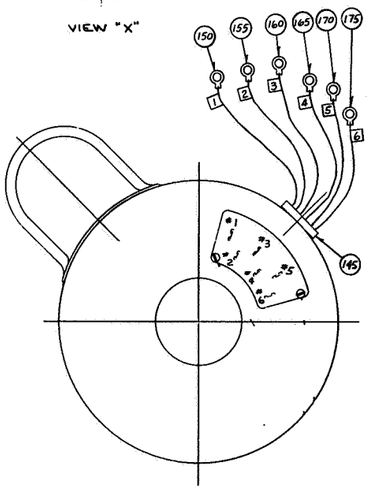
VIEW SHOWING MOUNTING OF PINION GEAR ON CLUTCH MODULE



VIEW "X"


FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "A"
FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "B"
FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "C"





Drawing F451614 Sh. 60, Rev. 2

Figure A-3. Gear Box and Motor Assembly

TOGGLE SPRING ASSEMBLY
Part No. N451614-0401
(See Figure A-4)

Item	Description	Part No.
1	Spring, Toggle	J680196
2	Retainer, Spring	M451614-2801
3	Cap, Spring Retainer	M451614-2101
4	Rod, Spring Retainer	M451614-1301
5	Nut, Spring Retainer	M191309
6	Fitting, 3/16 Alem. Str.	J039139
7	Bushing, 2 O.D.x1-1/4 I.D. Ball	J066415

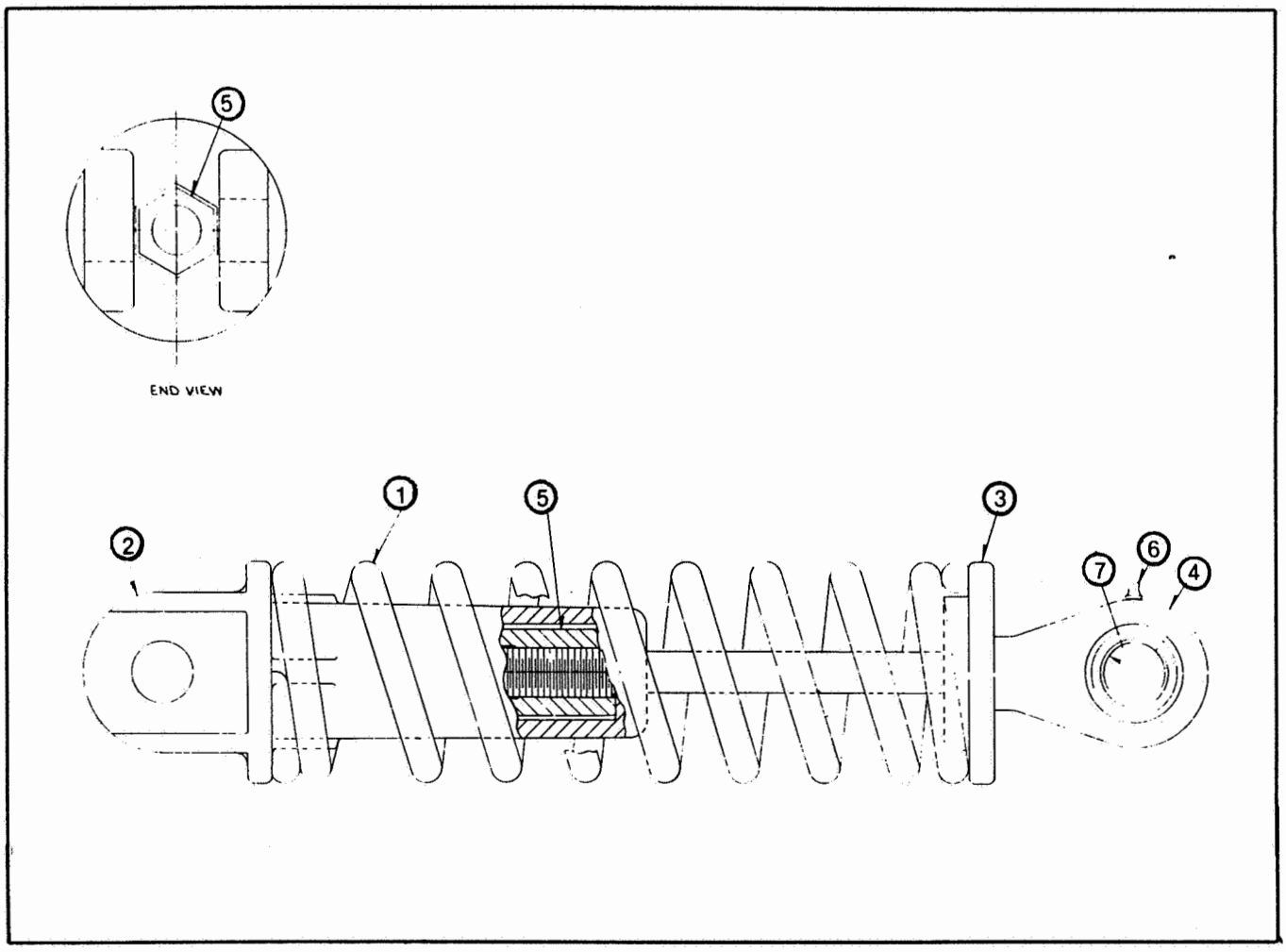
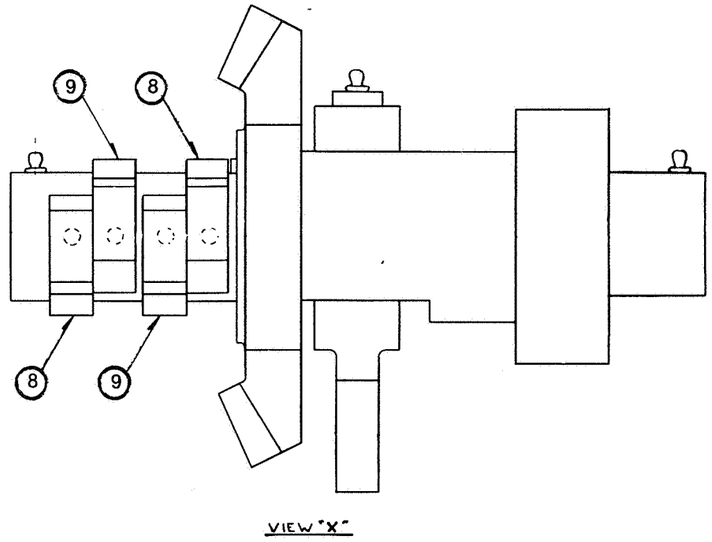
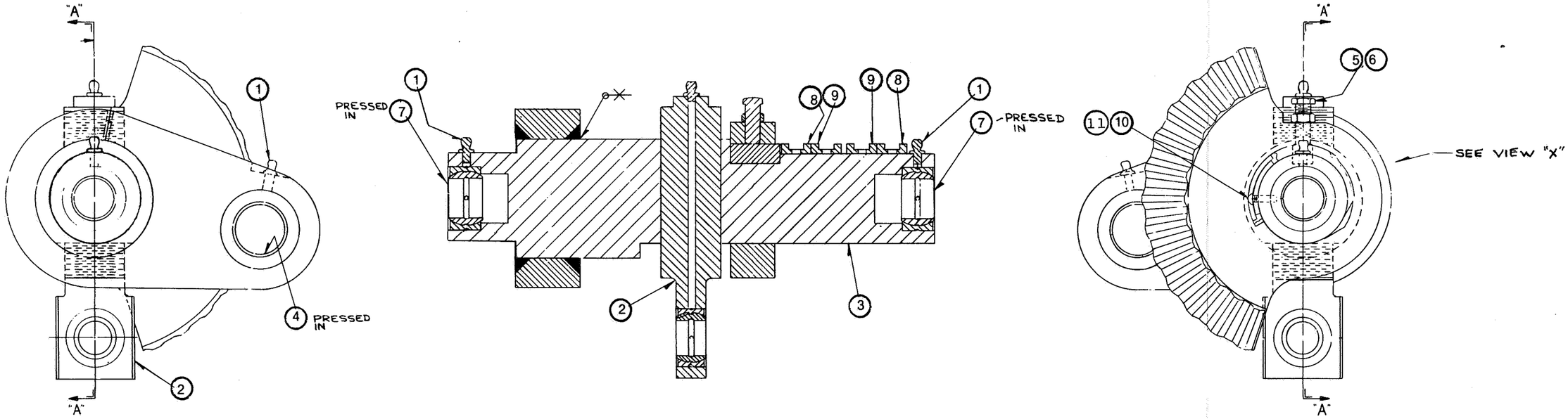


Figure A-4. Toggle Spring Assembly

OUTPUT CRANK SHAFT
(See Figure A-5)

Item	Description	Part No.
1	Fitting, 3/16 Alemite	J039139
2	Bolt, Adjustable Eye	N451614-3106
3	Shaft, Crank	R451614-0502
4	Bearing, Ball Bushing	J066415
5	Bolt, Hex., 3/8-16	J050053
6	Nut, Hex., 3/8-16	J048010
7	Bearing, Ball Bushing	J066414
8	Cam, Limit Switch	J776705
* 9	Cam, Limit Switch	J776706
10	Screw, BTN. HD., 10-32x5/8	J507373
11	Washer, #10 Shprf. Lock	J047715
	* For Output Crank Shaft assembly Part No. N451614-0501 Only	





Dwg. No. D451614 Sh. 5, Rev. 3

Figure A-5. Output Crank Shaft

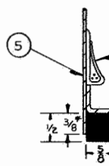
COVER ASSEMBLY WITH TWO COLOR POSITION LIGHTS
(See Figure A-6)

Item	Description	Part No.
5	Cover	R451614-4101
10	Gasket	A690969
15	Hood	N451614-4202
20	Ring, Lens	M451614-4203
25	Module, Lamp	M451614-4302
30	Lens, Green, 4-1/2 in. *Glass	J053142
35	Lens, Yellow, 4-1/2 in. *Glass	J053151
40	Screw, Thumb, 10-32 x 3/8	J507384
45	Screw, Rd. Hd., 10-32 x 5/8	J525281-0110
50	Screw, Rd. Hd., 1/4-20 x 1/2	J525269-0108
55	Washer, Steel Pl., #10	J475132-0110
60	Washer, Steel Pl., 1/4 in.	J475132-0112
65	Washer, Spring Steel LK, #10	J475131-0109
70	Washer, Spring Steel LK, 1/4 in.	J475131-0111
75	Plate, Mounting	M451614-4601
85	Socket, Lamp	J725895
90	Clamp, Cable	J709556
95	Harness	N451614-4701

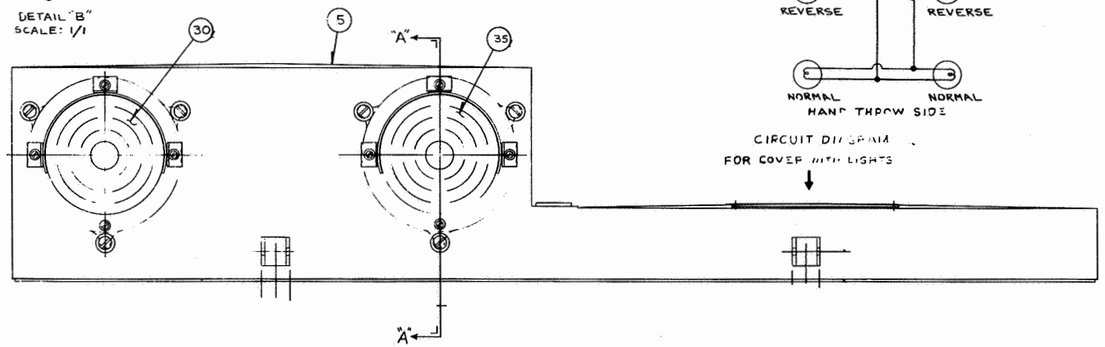
*Lens listed are for cover assembly, N451614-4401.
If lens other than these are required, please specify color, material, and lens location when ordering. See tabulation below.

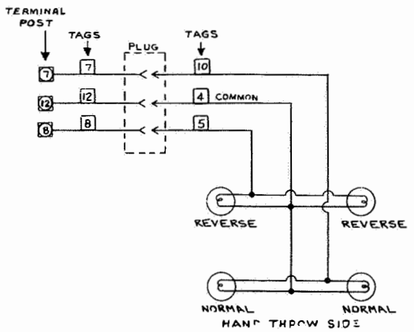
LENS

Color	Material	Part No.
Green	Glass	J053142
Yellow	Glass	J053151
Red	Glass	J053141
Green	Plastic	J531506
Yellow	Plastic	J531507
Red	Plastic	J531505
Lunar White	Plastic	J531504



DETAIL "B"
SCALE: 1/1



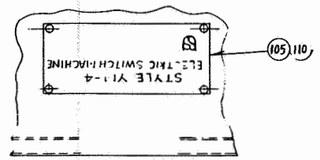


HAND THROW SIDE

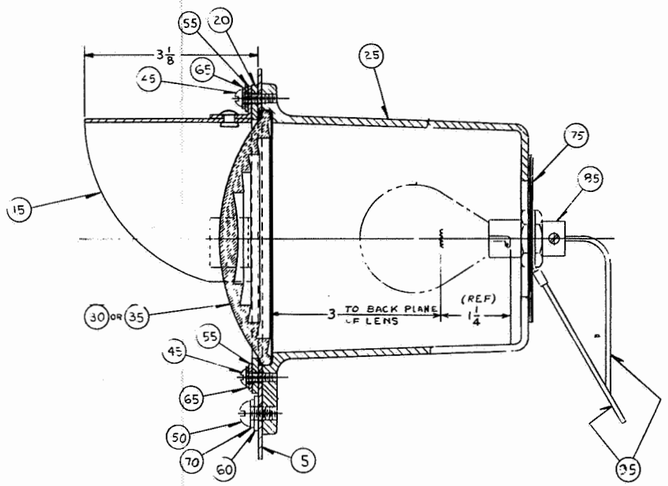
CIRCUIT DIAGRAM
FOR COVER WITH LIGHTS

SHOWING TERMINALS OF PLUGS FOR WIRING PURPOSES

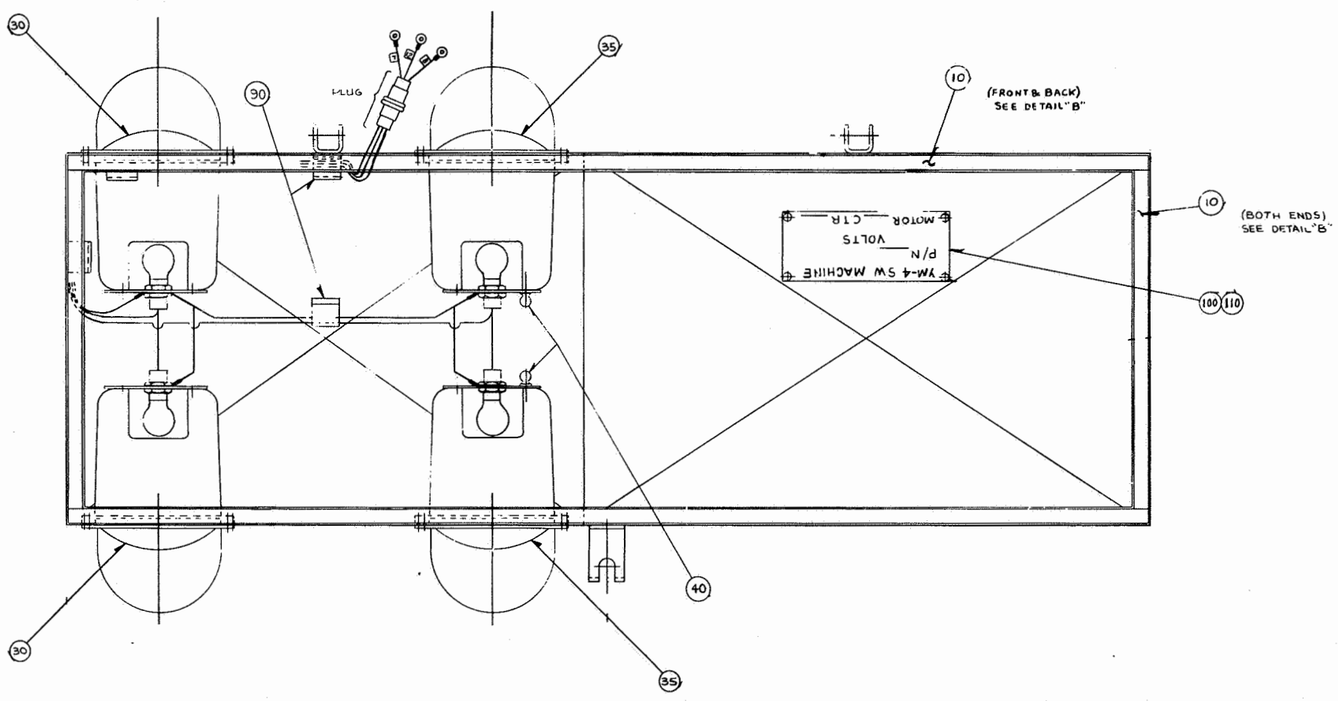
SUFFIX NO.	NORMAL		REVERSE		LENS MATERIAL
	LENS (30)	COLOR	LENS (35)	COLOR	
-4401	J053142	GREEN	J053151	YELLOW	GLASS
-4402	J531504	LUNAR WHITE	J531505	RED	PLASTIC (OPTICAL)
-4403	J531506	GREEN	J531507	YELLOW	PLASTIC (OPTICAL)
-4404	J531506	GREEN	J531505	RED	PLASTIC (OPTICAL)



VIEW IN DIRECTION OF ARROW
APPLICATION OF NAME PLATE
SCALE: 1/2



SECTION "A-A"

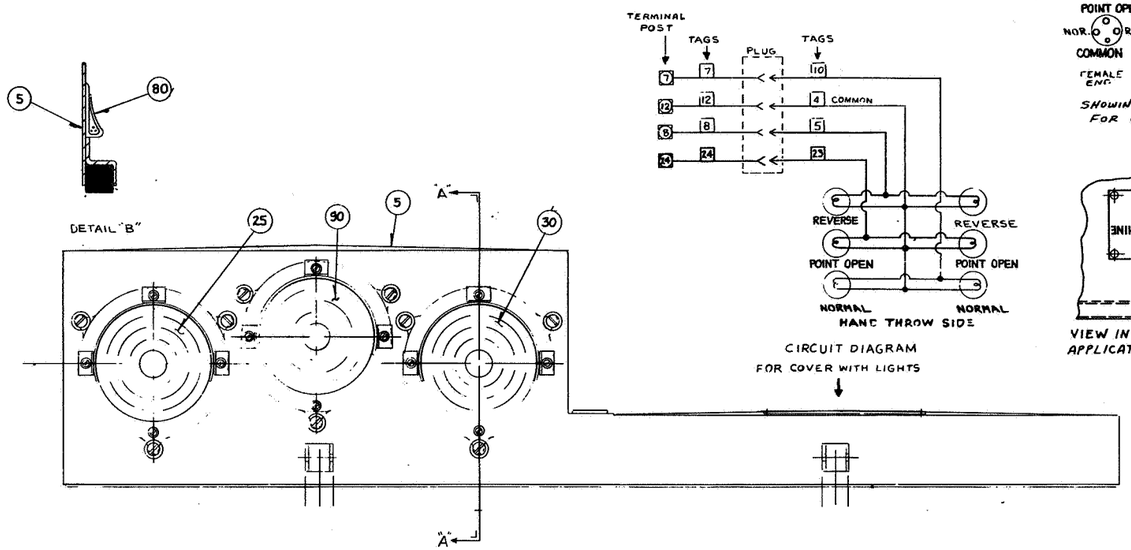


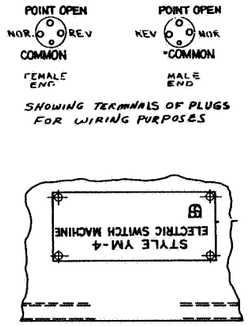
Drawing F451614 Sh. 44, Rev. 8

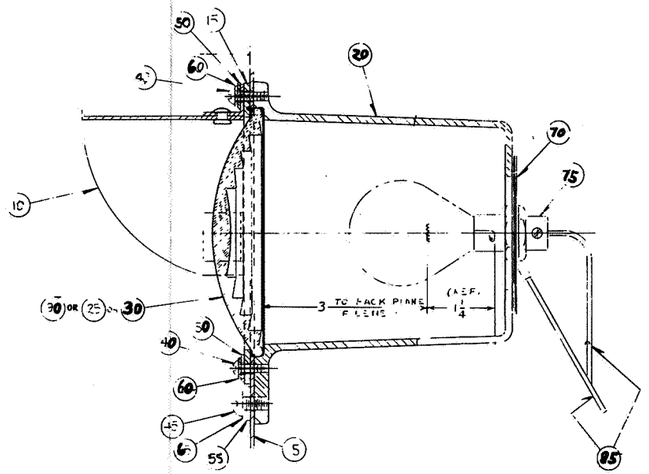
Figure A-6. Color Assembly With Two Position Lights
6231, p. A-21/A-22

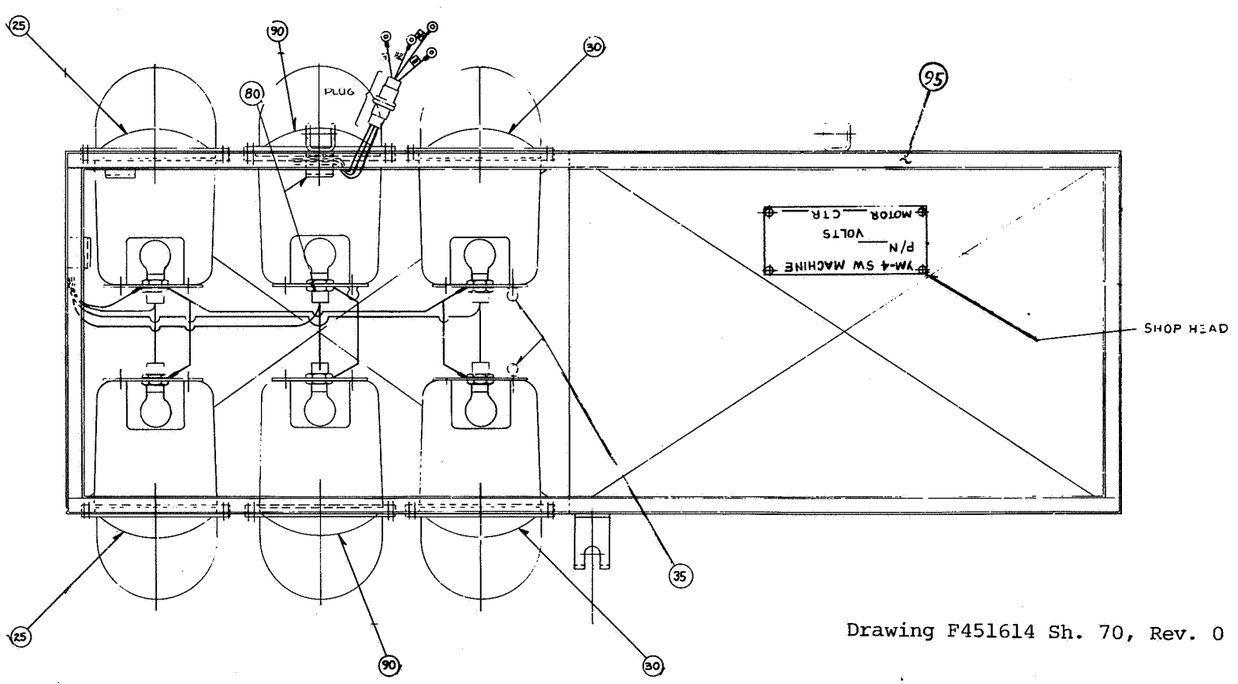
COVER ASSEMBLY WITH THREE POSITION LIGHTS
(See Figure A-7)

Item	Description	Part No.
	Cover Assembly (Complete)	N451614-7001
	Cover Assembly (Complete)	N451614-7002
5	Cover, Case	R451614-6901
10	Hood, Complete	N451614-4202
15	Lens Ring	M451614-4203
20	Lamp Module	M451614-4302
25	Lens, 4-1/2 in. Plastic Green (-7001)	J531506
	Lens, 4-1/2 in. Glass Green (-7002)	J053142
30	Lens, 4-1/2 in. Plastic Yellow (-7001)	J531507
	Lens, 4-1/2 in. Glass Yellow (-7002)	J053151
35	Screw, 10-32 x 3/8 Thumb	J507384
40	Screw, 10-32 x 5/8 Rd. Hd.	J525281-0110
45	Screw, 1/4-20 x 1/2 Rd. Hd.	J525269-0108
50	Washer, #10 Steel Pl.	J475132-0110
55	Washer, 1/4 in. Steel Pl.	J475132-0112
60	Washer, #10 Spring Steel LK	J475131-0109
65	Washer, 1/4 in. Spring Steel LK	J475131-0111
70	Mounting Plate	M451614-4601
75	Lamp Socket	J725895
80	Cable Clamp	J709556
85	Harness	N451614-6701
90	Lens, 4-1/2 Plastic Red (-7001)	J531505
	Lens, 4-1/2 Glass Red (-7002)	J053141
95	Gasket, 1/2x5/8	A690969
100	Contact Adhesive	A041988









Drawing F451614 Sh. 70, Rev. 0

Figure A-7. Cover Assembly With Three Position Lights

SERVICE MANUAL 6231
Appendix B

Parts List

ELECTRIC SWITCH MACHINE
YM-4

DUAL CONTROL, TRAILABLE

FOR SWITCH MACHINES MANUFACTURED BEFORE JANUARY 1, 1984

November, 1986 (Rev. 1/87)
ID1149A/DN0007A
D-11/87-75-2430-3

UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD INC / PITTSBURGH, PA 15237

YM-4 SWITCH MACHINE ASSEMBLIES

Motor	Indication Lights	US&S Part No.	Code
115 V AC/115V AC Control	--	N451613-0101	A
115 V AC/115V AC Control	Green/Yellow (Glass)	N451613-0102	B
230 V AC/115V AC Control	--	N451613-0103	C
115 V AC/115V AC Control	Lunar White/Red (Plastic)	N451613-0104	D
115 V DC/24-28V DC Control	--	N451613-0201	E

YM-4 SWITCH MACHINE ASSEMBLY PARTS LIST
Part No.'s 451613-0101, -01XX,
(See Figure B-1)

Item	Description	Part No.	Used On Code
1	Case	R451614-0901	All
2	Cover, w/out Position Indicating Lights	N451614-1401	A,E
	Cover	N451614-1402	C
	Cover, with Position Indicating Lights (See Figure B-6)	N451614-4401	B
	Cover Assembly	N451614-4402	D
3	Plug, Pipe 3/14-14 NPT	J032906	All
4	Gear Box w/Motor Assembly (See Fig. B-3)	N451614-0301	A,B,D
	Gear Box w/Motor	N451614-0302	C
	Gear Box w/Motor	N451614-5001	E
5	Bolt, 3/8-16 x 1-1/4 Hex. Hd	J050056	All
6	Washer, LK. 3/8	J047779	All
7	Pin Dowel	J703412	All
8	Spring, Toggle (See Figure B-4)	N451614-0401	All
9	Pin, Spring Block	M451614-2303	All
10	Pin, Toggle Spring	M451614-2302	All
11	Bolt, 1/2-13x1-3/4 Hex. Hd	J050095	All
12	Washer, LK. 1/2	J047783	All
13	Pin, Cotter 1/4 x 2	J048645	All
14	Shaft, Output Crank (See Figure B-5)	N451614-0501	A,B,D,E
14	Shaft, Output Crank	N451614-0503	C
15	Plate, Crank Shaft Mtg.	R451614-0103	All
16	Shim	M451614-0104	All
17	Bolt, 3/8-16x1" Hex. Hd.	J050053	All
18	Shaft, Hand Throw (See Figure B-2)	N451614-0601	All
19	Bolt, 1-13x6 Hex. Hd.	J050251	All
20	Trough, Wire	M451614-3205	All
21	Pin, Hinge	N451614-3105	All
22	Brkt. Limit Sw. Mtg.	M451614-3204	All
23	Bolt, 1/4-20 x 5/8 Hex. Hd.	J050013	All
24	Washer, LK 1/4	J047775	All
25	Nut, 1/4-20 Hex.	J048203	All
26	Bolt, 1/4-20x1 Hex. Hd.	J050019	All
27	Brkt., Limit Switch	M451614-3202	All
28	Brkt., Limit Switch	M451614-3203	All

Item	Description	Part No.	Used On Code
29	Switch Limit	J725666	A,B,D,E
30	Switch Limit	J725707-0193	All
31	Insulators	M451614-3208	A,B,D,E
32	Bellows	J751327	All
33	Plate, Bellows Mtg.	M451614-3601	All
34	Bolt, 1/4-20 x 1-1/4 Hex. Hd.	J050021	All
35	Nut, 1/4-20 Hex.	J048002	All
36	Washer, 1/4 PL.	J047501	All
37	Support, Lever Cam Shaft	R451614-1802	All
38	Bolt, 3/8-16 x 1-1/4 Hex. Hd.	J050056	All
39	Lever, Hand Throw	R451614-3403	All
40	Washer, LK 1"	J047823	All
41	Stud, Lever	M192069	All
42	Lever, Interlocking	R451614-2108	All
43	Bolt, 5/8-11 x 3-1/4 Hex. Galv.	M451614-2107	All
44	Nut, 5/8-11 Slotted Hex	J048074	All
45	Washer, 5/8 Pl. Brass	J475189	All
46	Washer, LK 5/8	J047822	All
47	Latch, Hand Throw	N451614-3001	All
48	Nut	M451614-3102	All
49	Pin, Cotter 1/8 x 1" Stl.	J048620	All
50	Grommet	J751324	All
51	Bolt, 1/2-13 x 1-1/4 Hex. Hd.	J050090	All
52	Brkt. Cut-out Sw. Mtg.	M451614-3201	All
53	Screw, 4-40 x 1-1/2 Rdh. St.	J525093	All
54	Contactor, Motor Rev.	J706448	A,B,C,D
	Contactor - Rev. 7.5 Hb	J709599	E
55	Screw, 10-32 x 5/8 RDH	J052566	All
56	Strip, Term. AAR 12 pole	J077653	All
57	Strip, Term. AAR 4 pole	M107471	All
58	Connector, Term. Strip	M451614-3206	All
59	Brkt. Term. Strip Mtg.	M451614-3207	All
60	Screw, 10-32 x 3/4 Fil. Hd.	J052299	All
61	Nut, 10-32 Hex. Stl.	J048172	All
62	Washer LK #10	J047733	All
63	Screw, #10-32 x 3/8 RDH	J052564	All
64	Nut, AAR	J480301	All
65	Nut, AAR Jam	J480300	All
66	Washer, AAR	J047818	All
67	Nut, Insulating	J048300	All
68	Strip, Jones Term.	J724351	All
69	Protector, Overload	J726153-0016	All
70	Heater	J713807	A,B,D
	Heater	J713154-0006	C
	Heater	J713154-0005	E
71	Resistor, 2K ohms 2 dA	J073817	A,B,D,E
	Resistor, 7.5K ohms 2 dA		C

Item	Description	Part No.	Used On Code
72	Harness	N451614-3801	A,B,D
	Harness	N451614-5201	C
	Harness	N451614-4901	E
73	Washer, #8 Shakeproof LK	J047892	All
74	Lead	N438713-001	A,B,C,D
	Lead	N451614-5101	E
75	Clamp, Trough	N451614-4802	All
76	Spring	M451614-4803	A,B,D
	Spring	M451614-4804	C
77	Test Link	J071626	All
79	Lead	N438713-007	A,B,C,D
	Lead	M451614-5102	E
80	Screw, 6-32 x 1/8 Rd. Hd.	J525241	All
81	Screw, 6-32 x 1 Rd. Hd.	J525097	All
82	Term., Ins. Faston 250	J731443	All
83	Term. Amp. (#6 Post)	J730077	All
84	Plate, Cover	M451614-1302	All
85	Clamp	J709590	All
86	Screw, #3-48 x 3/4" Rd. Hd.	J525234	All
87	Ventilator	N070109	All
88	Cap., Plug	J703392	All
90	Power Supply	J725709-0070	A,B,D
	Power Supply	J725709-0085	C
91	Socket, Octal	J792847	A,B,C,D
94	Cover, Gear Box	M451614-1303	All
95	Resistor, 800 ohms, 30 Watt	J720074	C
96	Nut, Jam 3/8-16	J048010	All
97	Latch, Assembly with Hasp	J792898	All
98	Bolt, 1/4-20 x 3/4 Hex. Hd.	J050016	All
100	Spacer	M451614-2106	All
101	Pin, Cotter 5/32 x 1-1/2 Stl.	J048627	All
	Lubricant Stazon-M	A041477	All
	Ties, Cable	J703360	All
103	Plate-Name	N451607-7101	All
104	Lead	M438876	C
105	Screw, 10-32 x 1/2 In. Rd.	J052565	C
106	Screw, 10-32 x 9/16 Rdh. St.	J525046	C
107	Washer, 10 Stl. Lk. Med.	J047733	C
108	Resistor, 800 Ohms 30 Watt	J720074	C
109	Switch, 6-amp 125V SP ST	J724515	C
110	Bracket, HTR Mounting	M451563-5101	C
112	Screw, 10-32 x 7/8 Rd. Hd.	J052568	E
113	Stud, Hasp	M387732	All
114	Screw, 3/8 x 1-1/2 Hex. Hd.	J050057	All
115	Pin-Roll Elas. Stp. Nt.	J487025	All
116	Washer	M391200	All
117	Hasp	N072832	All
118	Washer, 10 Shprf. Lk	J047715	All
119	Washer, 10 Flt. Stl. Coml.	J475077	A,B,C,D
120	Clamp, Cable	J709556	All
121	Shim, Top and Bottom	M451174-0601	All
122	Shim, Side	M451174-0701	All

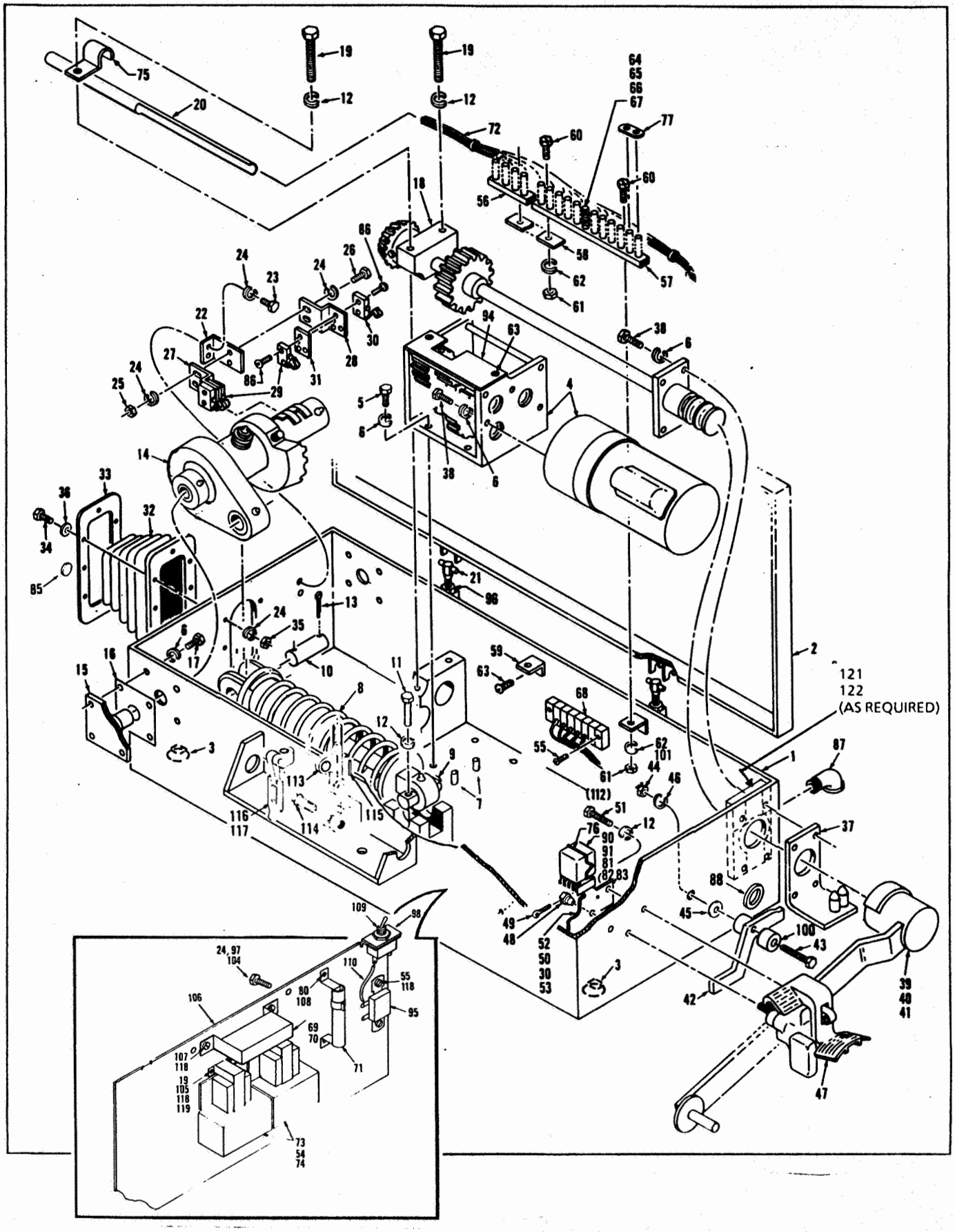


Figure B-1. YM-4 Electric Switch Machine, Exploded View

HAND THROW SHAFT PARTS LIST
Part No. N451614-0601
(See Figure B-2)

Item	Description	Part No.
1	Gear, Bevel	M451614-2701
2	Key	M451614-3508
3	Nut, 3/8-16 Hex. Jam	J048010
4	Screw, 3/3-16 x 1-1/4 Hex. Hd.	J050056
5	Washer, Lock	J407786
6	Nut, Lock	J048573
7	Shaft	R M451614-~~2402~~ 6402
8	Bearing, Ball	J066368
9	Ring, RTNG	J079344
10	Washer	M451614-3503
11	Ring, RTNG	J079388
12	Gear	M451614-2506
13	Key	M451614-3507
14	Brg., Ball Bushing	J066426
15	Ring, RTNG	J792964
16	Bracket, Mtg.	R451614-2203
17	Housing, Upper BRG.	M451614-0802
	(The following items are for reference only)	
22	Screw, 3/8-16 x 1-1/4 Hex. Hd.	J050056
23	Washer, 3/8 Stl. Lk. Med.	J047779
24	Case, YM-4 Switch Machine	R451614-0901
25	Support, Lever Shaft	R451614-1802

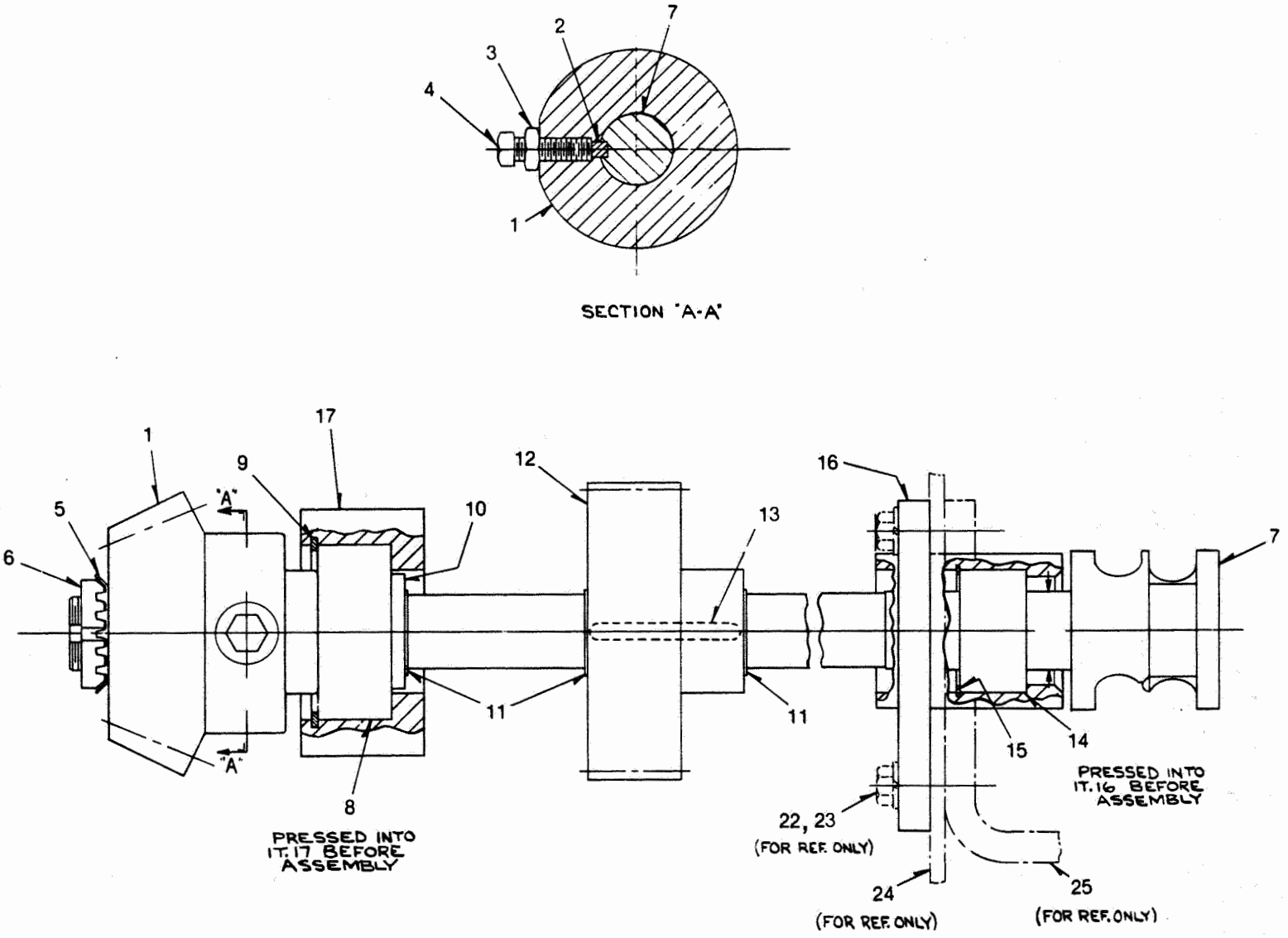
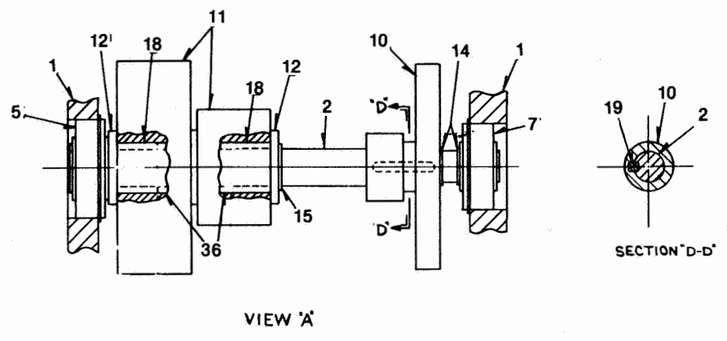


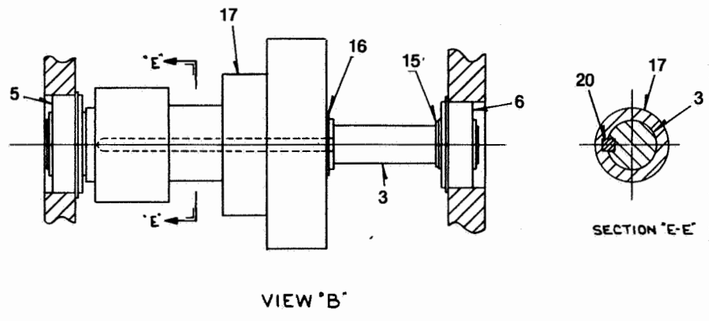
Figure B-2. Hand Throw Shaft

GEAR BOX AND MOTOR ASSEMBLY PARTS LIST
(See Figure B-3)

Item	Description	Part No.
1	Frame, Gear Box	R451614-0201
2	Shaft	M451614-1701
3	Shaft	M451614-1702
4	Shaft	M451614-1703
5	Bearing, Ball	J066419
6	Bearing, Ball	J066418
7	Bearing, Ball	J066417
8	Cup, Bearing Ball	J066420
9	Bearing,	J066421
10	Gear	M451614-2501
11	Gear	M451614-2504
12	Washer	M451614-3510
13	Screw, 3/8-16 x 1-1/4 Hex Hd.	J050056
14	Ring, Retaining	J792852
15	Ring, Retaining	J792853
16	Ring, Retaining	J792854
17	Gear	M451614-2503
18	Bearing, Needle RLR Cage	J066416
19	Key	M451614-3504
20	Key	M451614-3505
21	Key	M451614-3506
22	Gear	M451614-2502
23	Ring, Retaining	J792849
24	Module, Electro Clutch	J792843
25	Motor, 1 HP 115/230 Vac	J717245-0001
	Motor, Perm. Magnet 115 Vdc	J717250
26	Gear, Pinion	M451614-2505
27	Screw, 1/4-20 x 1/4 SAF. Set	J050500
28	Washer, 3/8 Lock	J047779
29	Grommet	J751127



VIEW "A"



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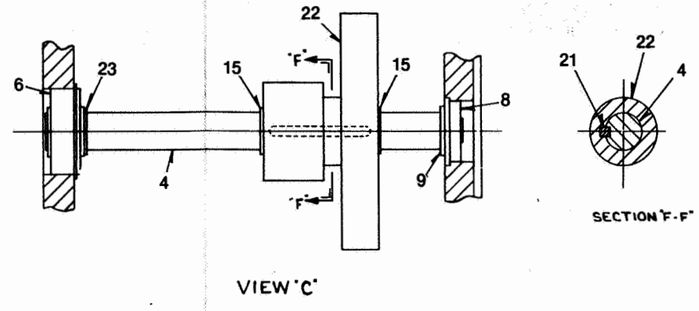
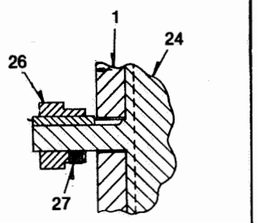
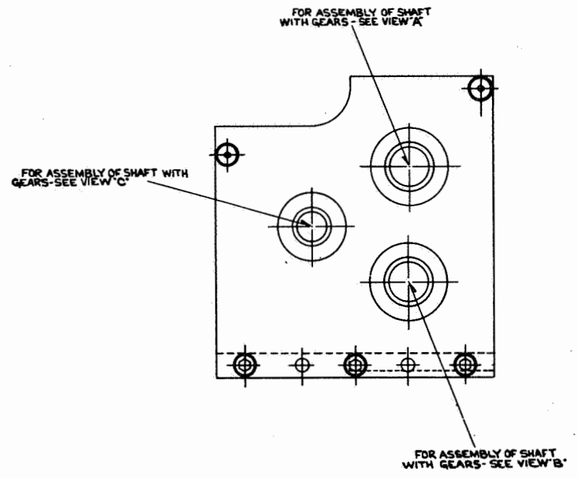
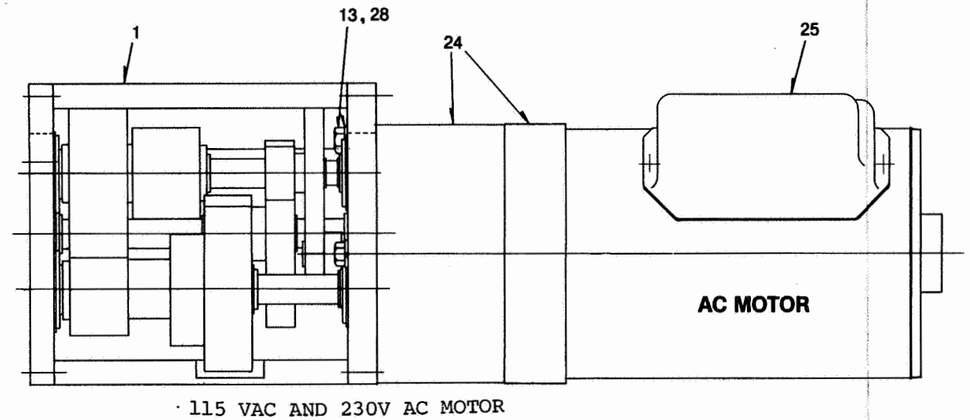


VIEW "C"

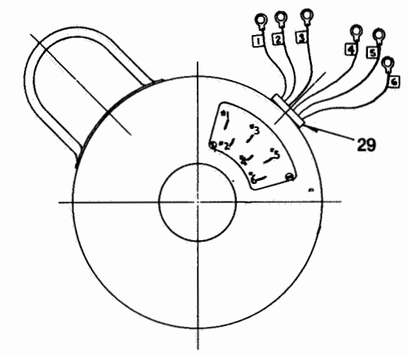


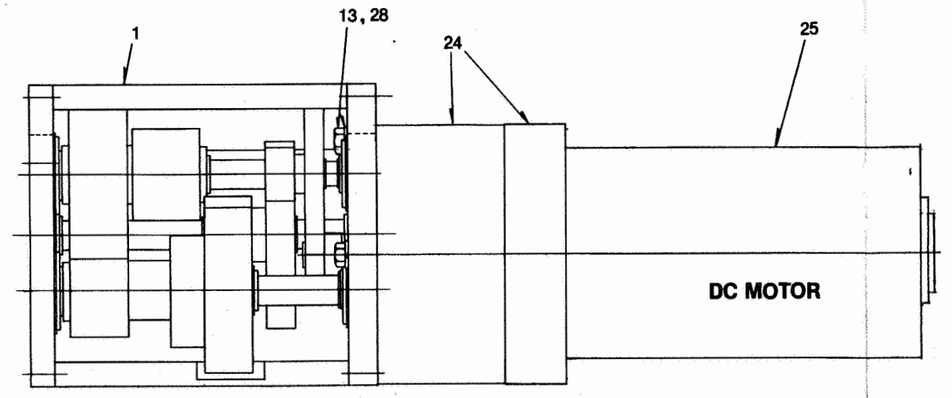
VIEW SHOWING MOUNTING OF PINION GEAR ON CLUTCH MODULE


FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "A"
FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "C"
FOR ASSEMBLY OF SHAFT WITH GEARS - SEE VIEW "B"

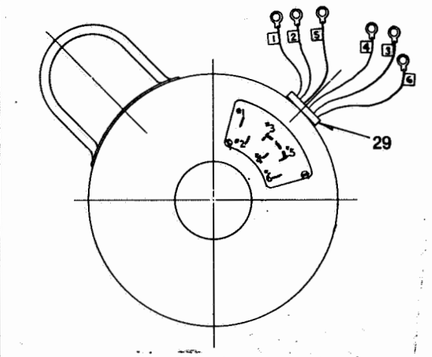


115 VAC AND 230V AC MOTOR





115V DC MOTOR



FOR MOTOR PART NUMBER SUFFIX -0103 ONLY

Dwg. No. F451614, Sh. 3, Rev.3 (AC Motor)
Dwg. No. F451614, Sh. 50, Rev. 0 (DC Motor)

Figure B-3. Gear Box and Motor Assembly

TOGGLE SPRING ASSEMBLY
Part No. N451614-0401
(See Figure B-4)

Item	Description	Part No.
1	Spring, Toggle	J680196
2	Retainer, Spring	M451614-2801
3	Cap, Spring Retainer	M451614-2101
4	Rod, Spring Retainer	M451614-1301
5	Nut, Spring Retainer	M191309
6	Fitting, 3/16 Alem. Str.	J039139
7	Bushing, 2 O.D.x1-1/4 I.D. Ball	J066415

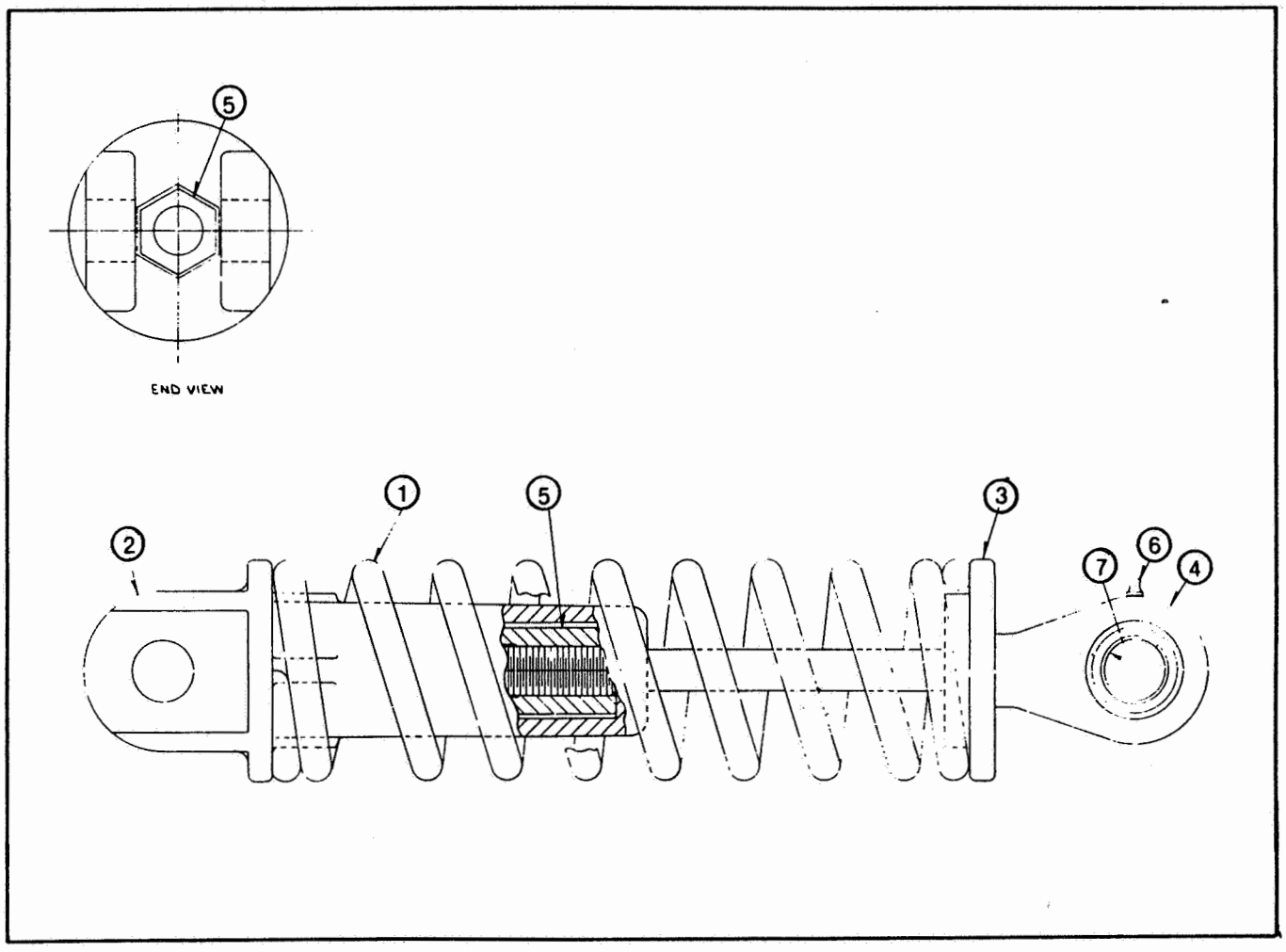
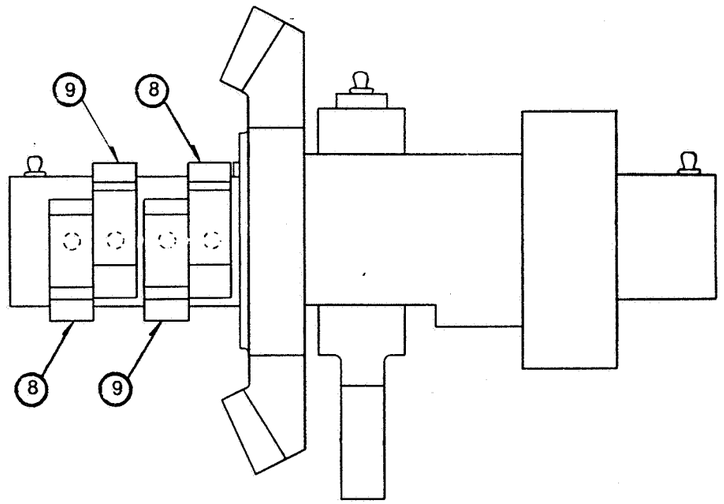


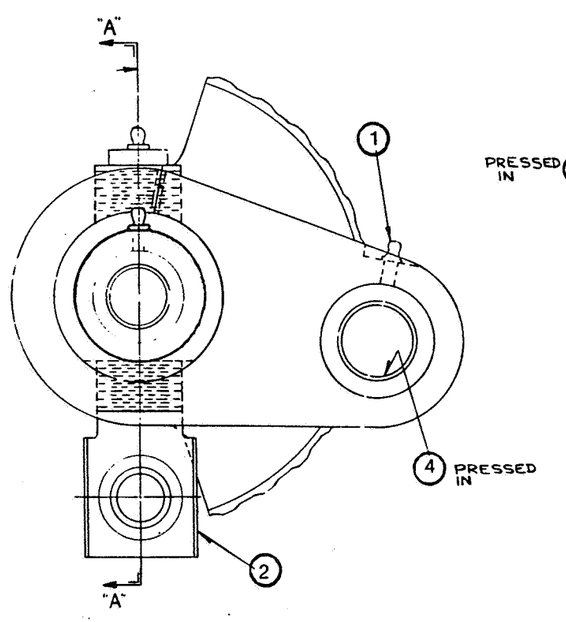
Figure B-4. Toggle Spring Assembly

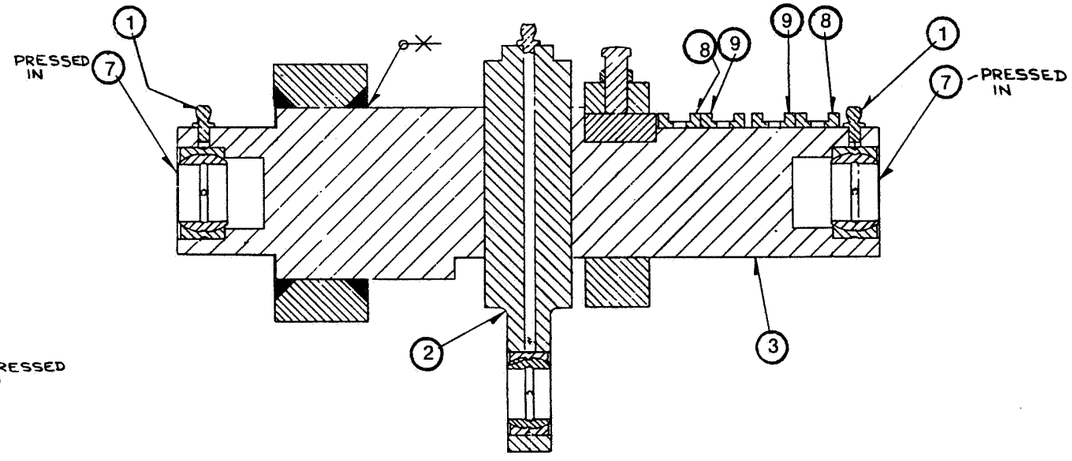
OUTPUT CRANK SHAFT
(See Figure B-5)

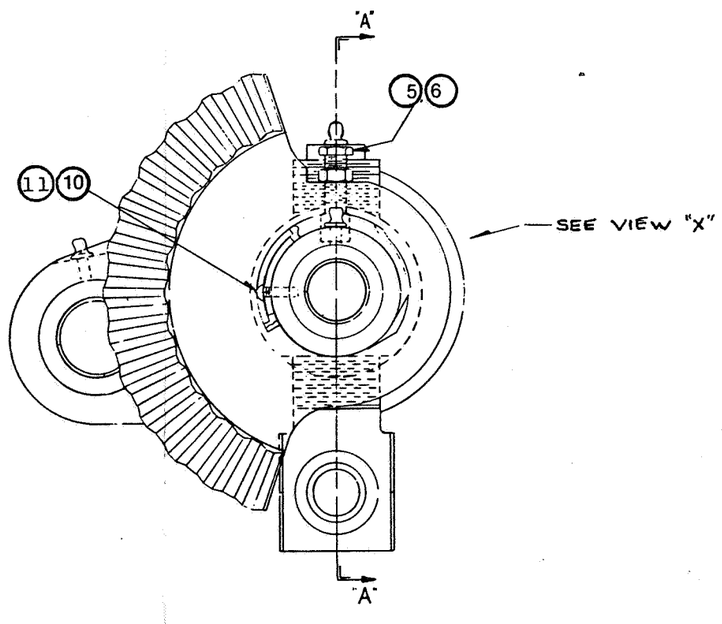
Item	Description	Part No.
1	Fitting, 3/16 Alemite	J039139
2	Bolt, Adjustable Eye	N451614-3106
3	Shaft, Crank	R451614-0502
4	Bearing, Ball Bushing	J066415
5	Bolt, Hex., 3/8-16	J050053
6	Nut, Hex., 3/8-16	J048010
7	Bearing, Ball Bushing	J066414
8	Cam, Limit Switch	J776705
* 9	Cam, Limit Switch	J776706
10	Screw, BTN. HD., 10-32x5/8	J507373
11	Washer, #10, Shprf. Lock	J047715
	* For output cam shaft assembly Part No. N451614-0501 Only	



VIEW "X"







Dwg. No. D451614 Sh. 5, Rev. 3

Figure B-5. Output Crank Shaft

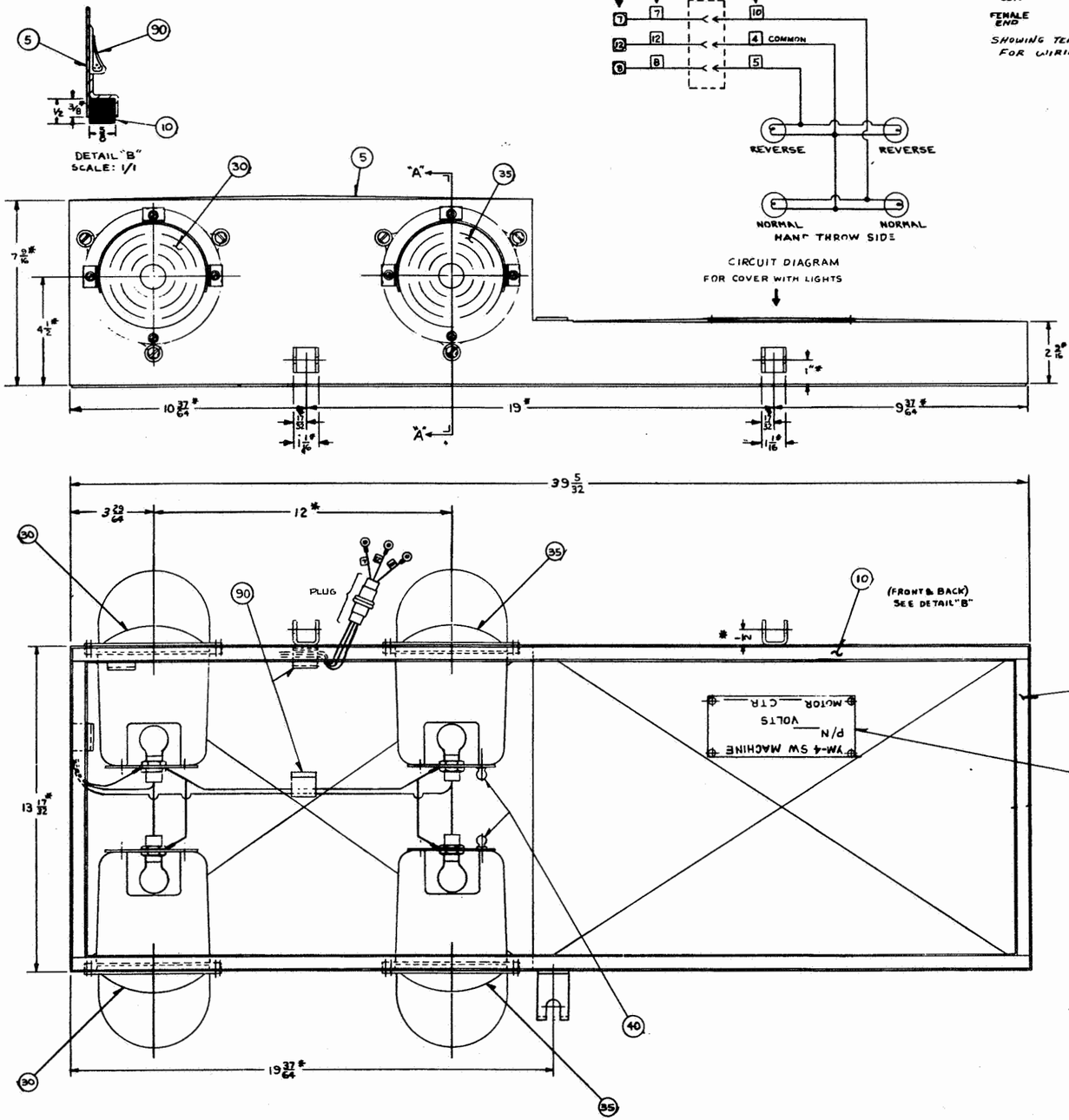
COVER ASSEMBLY WITH GREEN/YELLOW-GLASS COLOR POSITION LIGHTS
(See Figure B-6)

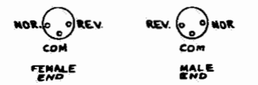
Item	Description	Part No.
5	Cover	R451614-4101
10	Gasket	A690969
15	Hood	N451614-4202
20	Ring, Lens	M451614-4203
25	Module, Lamp	M451614-4302
30	Lens, Green, 4-1/2 in. *Glass	J053142
35	Lens, Yellow, 4-1/2 in. *Glass	J053151
40	Screw, Thumb, 10-32 x 3/8	J507384
45	Screw, Rd. Hd., 10-32 x 5/8	J525281-0110
50	Screw, Rd. Hd., 1/4-20 x 1/2	J525269-0108
55	Washer, Steel Pl., #10	J475132-0110
60	Washer, Steel Pl., 1/4 in.	J475132-0112
65	Washer, Spring Steel LK, #10	J475131-0109
70	Washer, Spring Steel LK, 1/4 in.	J475131-0111
75	Plate, Mounting	M451614-4601
85	Socket, Lamp	J725895
90	Clamp, Cable	J709556
95	Harness	N451614-4701

*Lens listed are for cover assembly, N451614-4401.
If lens other than these are required, please specify color, material, and lens location when ordering. See tabulation below.

LENS

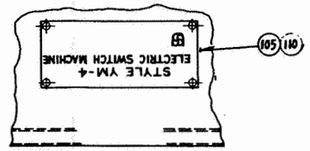
Color	Material	Part No.
Green	Glass	J053142
Yellow	Glass	J053151
Red	Glass	J053141
Green	Plastic	J531506
Yellow	Plastic	J531507
Red	Plastic	J531505
Lunar White	Plastic	J531504



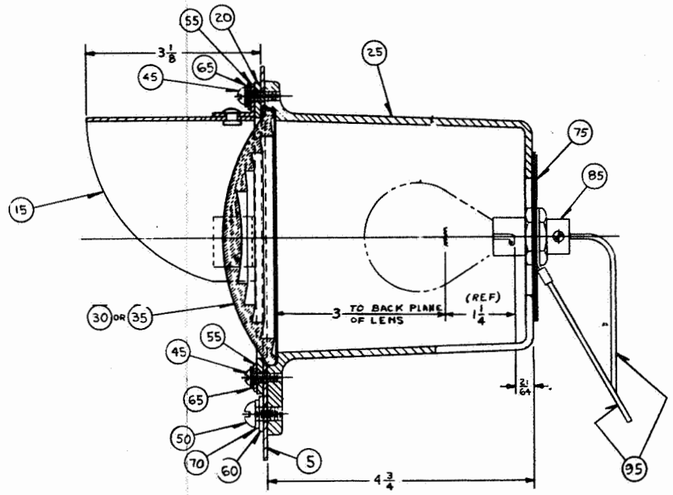


SHOWING TERMINALS OF PLUGS FOR WIRING PURPOSES

SUFFIX NO.	NORMAL		REVERSE		LENS MATERIAL
	LENS (30)	COLOR	LENS (35)	COLOR	
-4401	J053142	GREEN	J053151	YELLOW	GLASS
-4402	J531504	LUNAR WHITE	J531505	RED	PLASTIC (OPTICAL)
-4403	J531506	GREEN	J531507	YELLOW	PLASTIC (OPTICAL)
-4404	J531506	GREEN	J531505	RED	PLASTIC (OPTICAL)



VIEW IN DIRECTION OF ARROW
APPLICATION OF NAME PLATE



SECTION "A-A"

ALL DIMENSIONS MARKED * ARE FOR REF. ONLY.

Drawing F451614 Sh. 44, Rev. 8

Figure B-6. Cover Assembly With Green/Yellow Color Position Lighhts